Abdominal complications resulting from systemic chemotherapy: what the radiologist needs to know

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Learning objectives

The purpose of this exhibit is: to review of the main manifestations of hepatic, pancreatic and gastrointestinal tract complications secondary to chemotherapy.

Background

Complications of chemotherapy are wide ranging and relatively common. We wished to compile a review of the main manifestations of hepatic, pancreatic and gastrointestinal tract complications secondary to chemotherapy that radiologist needs to know to the diagnosis.

A systematic organ-based review of these complications is presented, including but not limited to hepatic changes after chemotherapy, pancreatic, gastrointestinal manifestations, various opportunistic infections …

Findings and procedure details

the increasing use of novel and combination drug regimens is accompanied by a rise in incidence of their short-term and long-term toxic effects and complications(1). Although a wide variety of drugs may lead to complications involving various organ systems in the abdomen and pelvis, only a limited number of these reveal characteristic or specific injury patterns and imaging appearances.

Liver :

1/Hepatic Steatosis :under chemotherapy up to 85% of patients develop liver steatosis indicating disturbed lipid metabolism via altered lipoprotein synthesis in the hepatocytes. (2)

Ultrasound :Steatosis manifests as increased echogenicity and beam attenuation

CT :Steatosis causes reduced liver attenuation. This results in: low hepatic density compared to spleen during pre-contrast and portal venous phase imaging.

MRI :Requires both in- and out-of-phase imaging and contrast to be adequately assessed ¹. Fatty liver appears:
T1 - hyper intense

T2 - mildly hyper intense

**out-of-phase imaging** - signal drop out in fatty liver in out of phase.(3)

2/ **Hepatocellular Injury: Necrosis, Fibrosis, Cirrhosis**:

Advanced stages of hepatocellular injury may rarely progress to cirrhosis or pseudocirrhosis.

Cirrhosis manifests as shrunken nodular liver with atrophic right and medial left lobes and hypertrophy of caudate and lateral left lobes (4).

3/ **Microvascular Injury: Venoocclusive Disease, Peliosis, Sinusoidal Obstructive Syndrome, Sclerosing Cholangitis** (Fig1):

Chemotherapy-associated sclerosing cholangitis appears similar to primary sclerosing cholangitis,

with predominant involvement of perihilar ducts(5) Other long-term consequences of microvascular injury include venoocclusive disease, sinusoidal obstructive syndrome, peliosis hepatis, and nodular regenerative hyperplasia(6).

Early stages of sinusoidal obstructive syndrome, may not manifest on ultrasound or CT.

Advanced stages may present with a heterogeneous mosaic pattern of enhancement, hepatomegaly, ascites, and periportal edema-features similar to Budd-Chiari syndrome(7).

**Pancreas**

Common side effects of chemotherapy on the pancreas include acute pancreatitis and pancreatic atrophy (8) Diffuse pancreatic enlargement with peripancreatic inflammation is diagnostic for chemotherapy-induced acute pancreatitis in the correct clinical setting. Imaging may not differentiate drug-induced acute pancreatitis from other causes of acute pancreatitis. In addition to the diagnostic value of imaging in acute pancreatitis, CT enables one to determine the severity of this condition. This adds an early prognostic value to the study and helps clinicians decide on whether intensive monitoring and specific therapies are required(8).

**Gastrointestinal Tract :**(Fig2,3)
ranging from mucosal erosions and ulcerations to frank colitis and, in extreme cases, perforation.

1/Neutropenic enterocolitis: has been known by several names, including typhlitis (from the Greek *typhon*),(9) neutropenic colitis, necrotizing enterocolitis, ileocecal syndrome, and cecitis.(10) Imaging shows diffuse thickening of the colonic wall with surrounding inflammatory stranding and ascites. Marked submucosal edema leads to an appearance described as the accordion sign on CT(11).

2/Ischemic Colitis: Bowel necrosis or perforation may be a direct effect of the drug's rendering microtubule bundles nonfunctional, resulting in transient mitotic arrest.(12). The radiographic findings are not specific. CT scan of abdomen and pelvis may reveal involvement of any segment of the bowel or pan colitis, peritoneal stranding, and/or ascites(13), arterial or venous occlusion, and hepatic portal or portomesenteric venous ...

**Urinary Bladder:**

A number of cancer chemotherapeutic agents can cause complications related to the urinary bladder. These include infectious and noninfectious (hemorrhagic or emphysematous) cystitis. Cyclophosphamide-induced hemorrhagic cystitis is a prototypical example of a chemotherapy-induced complication affecting the urinary bladder(14).

**fungal infection:**

Besides the lungs and the sinuses, fungal microabscesses may be seen in the liver, spleen, and kidneys. These are most commonly caused by *Candida*, but may also occur due to *Aspergillus*.

Similarly, in the abdomen, fungal infection can cause low attenuation areas on CT in the liver, spleen, or kidneys, which may be mimicked by metastases, lymphoma, pyogenic abscesses, and tuberculosis. The diagnosis may be difficult because blood cultures may be negative and the symptoms non specific (15).
Fig. 1: Case 1: VOD History: 65F, ovarian Ca and melanoma, liposomal doxorubicin. response to treatment. Findings: patchy abnormal enhancement of liver parenchyma with a peripheral distribution.
Fig. 2: Case 2: Enteropathy History: 71F, sigmoid adeno-carcinoma, renal cell carcinoma, on weekly 5FU, presenting with nausea and abdominal pain. Note: bowel wall oedema, abnormally enhancing bowel and target sign, seen in the right lower quadrant.
Fig. 3: Case 3: Small bowel enteropathy History: 60M, gastric Ca, neoadjuvant chemotherapy. Presented with collapse and abdominal pain. Findings: Bowel wall oedema, abnormally dilated bowel, pericolic fat stranding. Nonspecific findings which may represent colitis or ischaemia
Conclusion

Early diagnosis of complications resulting from systemic chemotherapy in oncology patients is important, but diagnosis may be difficult through imaging because of the non-specific changes and the presence of abnormalities from the underlying disease. Even if a specific diagnosis cannot be reached, imaging is useful to monitor response to treatment and detect complications.

Personal information

References