Revisit to the Mesentery Disease from Neoplasm to Non-Neoplasm: Self-Assessment Module to Review Key CT Imaging Features

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Learning Objectives

- To illustrate the characteristic CT appearances of mesentery diseases, subdividing into neoplastic and non-neoplastic pathology

- To discuss the differential diagnosis of mesenteric diseases

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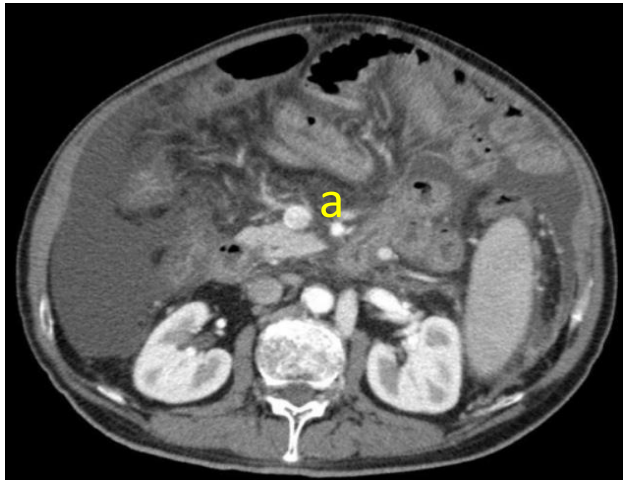
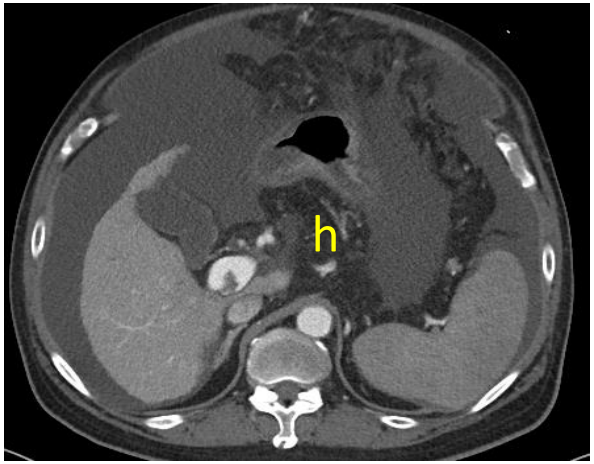
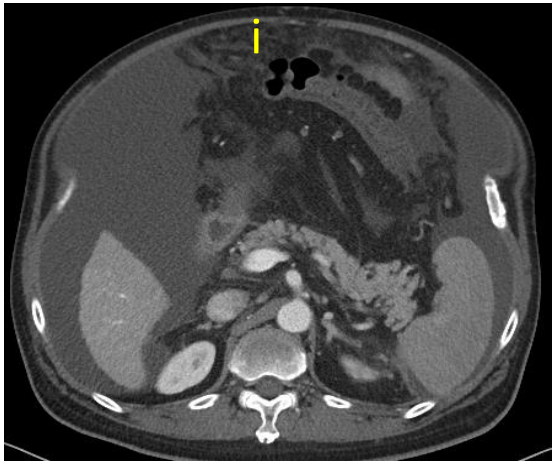
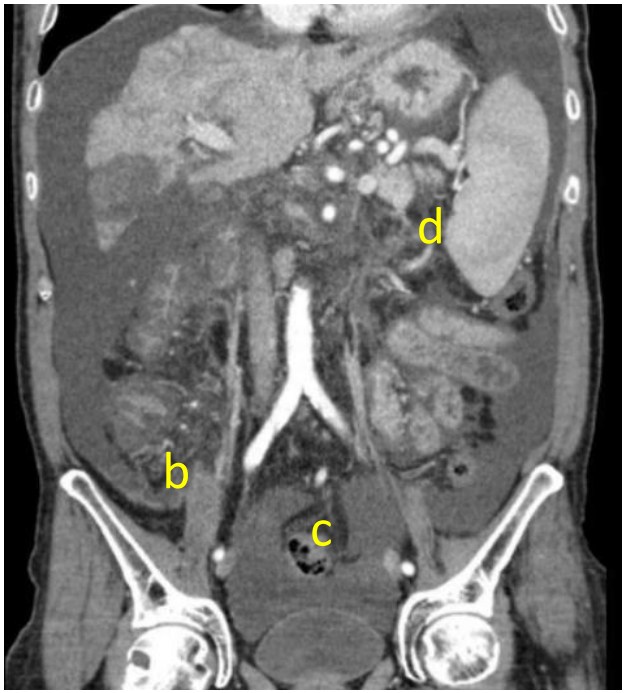
Background

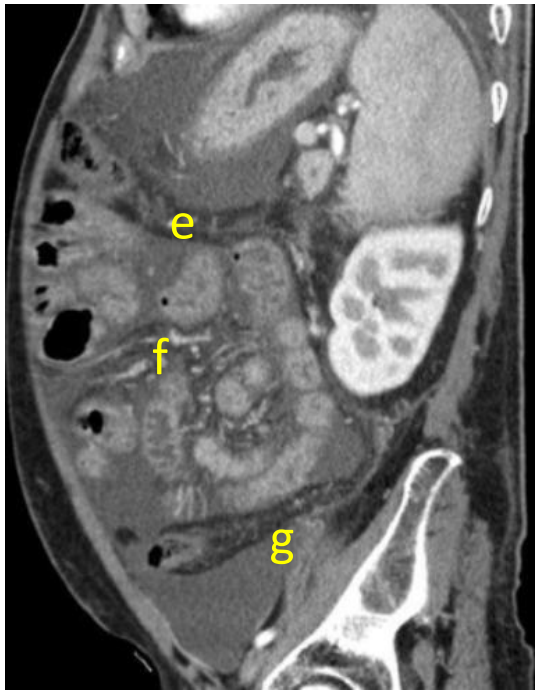
Beyond commonly encountered cases of peritonitis, there are a variety of uncommon diseases arising from the mesentery and peritoneum either benign or malignant. The imaging findings of these diseases appear as a combination of various forms such as peritoneal thickening, nodules, ascites, calcifications, or mass. As these imaging findings are complex and are often nonspecific, many of these diseases have similar and differential diagnosis is often difficult. However, each disease also has unique imaging findings. This exhibition consists of the self-assessment model. We review the key imaging features of common or uncommon mesenteric or peritoneal-origin diseases and provide schematic differential point focusing each disease's unique imaging findings.











a	Small bowel mesentery
b	Mesoappendix
c	Sigmoid mesocolon
d	Transverse mesocolon
e	Transverse mesocolon
f	Small bowel mesentery
g	Sigmoid mesocolon
h	Lesser omentum
i	Greater omentum

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Anatomy of peritoneal space (1)

- The peritoneum is a thin serous membrane that covers the surface of the peritoneal cavity and its mesenteries, formed by a single layer of simple low-cuboidal epithelium called a “mesothelium.” The visceral peritoneum covers the intraperitoneal organs, omenta, and mesenteries. The parietal peritoneum lines the anterior, lateral, and posterior abdominal walls.
- Peritoneal ligaments, mesentery, and omentum divide the peritoneum into two compartments: greater and lesser sacs.
- Pathologic processes can disseminate throughout this space via the movement of fluid and cells. It is potential for disease extension within the subperitoneal space, which lies deep to the surface lining of the visceral and parietal peritoneum, and become the routes of spread of primary and secondary malignancies and infection.
- Peritoneal ligaments are double layers of peritoneum that support a structure within the peritoneal cavity; omentum and mesentery are specifically named peritoneal ligaments. They are composed of fat, connective tissue, blood vessels, nerves, and lymphatics.

Anatomy of peritoneal space (2)

- Mesentery
  - Connects an intraperitoneal organ to the posterior abdominal wall
  - Small bowel mesentery, transverse mesocolon, sigmoid mesentery
- Omentum
  - Specialized mesenteries that extends from the stomach and duodenal bulb or appendix to adjacent organs
  - Greater omentum, lesser omentum, mesoappendix
    - Greater omentum
      - Extends from the greater curvature of stomach and spleen to transverse colon, passing in front of small bowel
      - Composed of gastrocolic, gastrosplenic, and gastrophrenic ligaments
    - Lesser omentum
      - A combination of gastrohepatic (portal vein, hepatic artery, and main common duct) and hepatoduodenal ligaments (left gastric vessels and lymph nodes)
      - Connects the lesser curvature of the stomach and proximal duodenum to the liver

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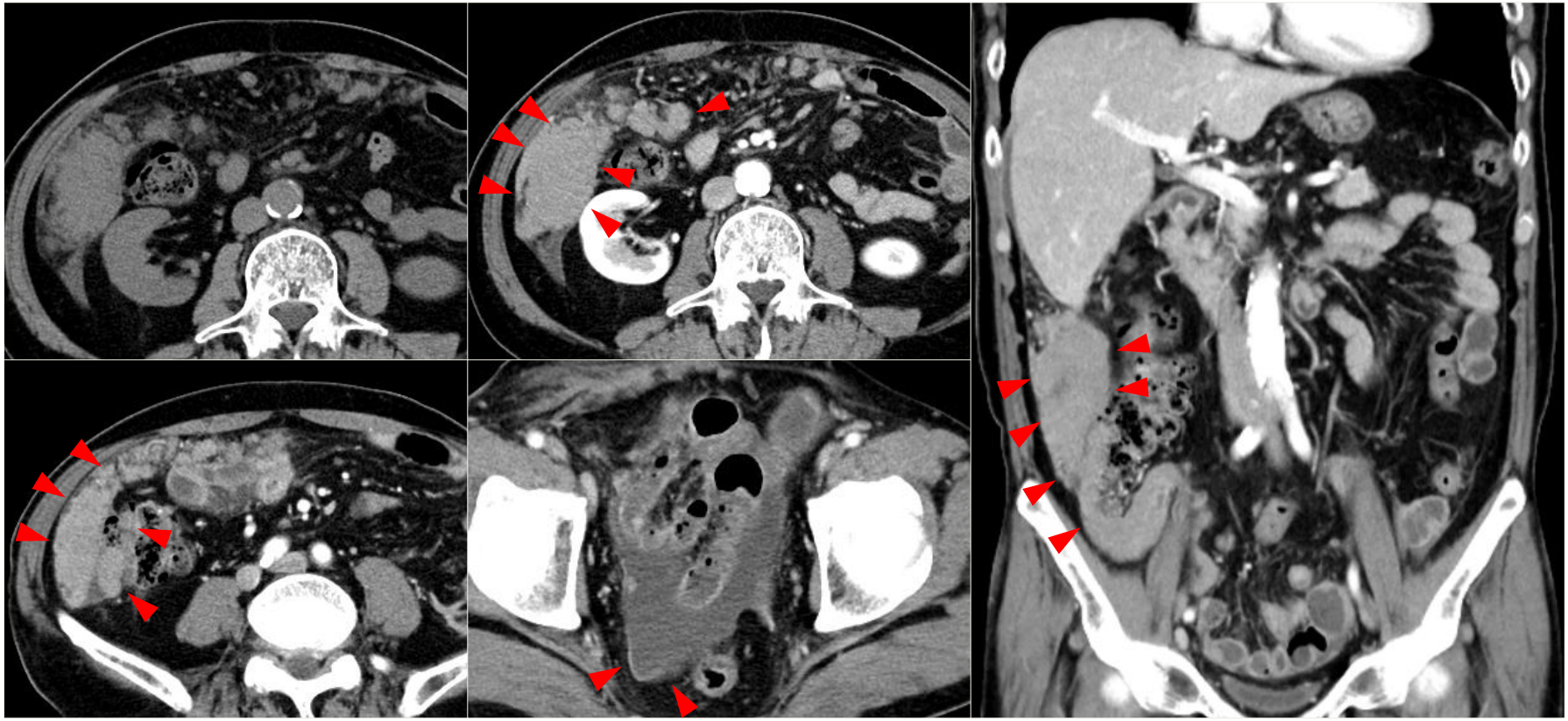
Primary Peritoneal Neoplasm

What is the most likely diagnosis ?



A 72-year-old male

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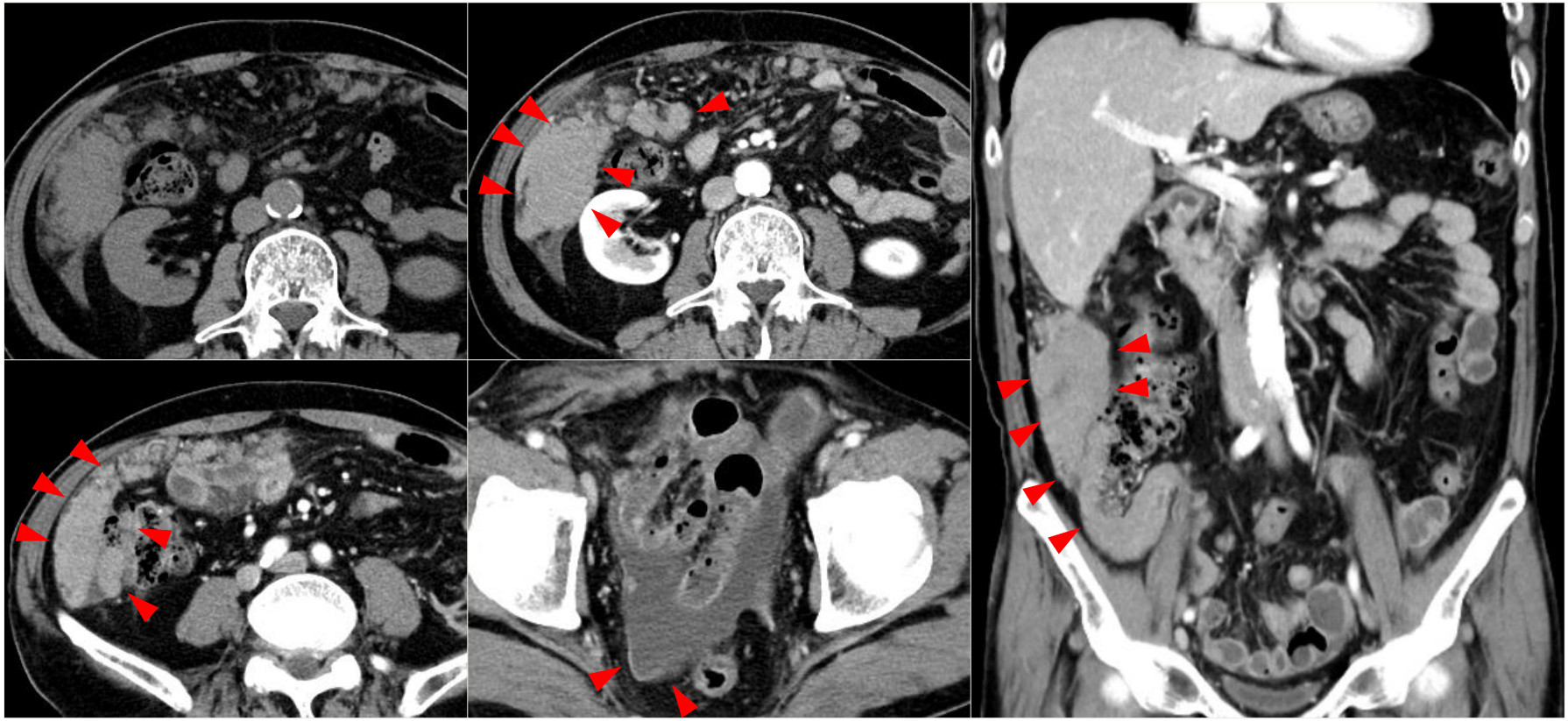
Malignant Mesothelioma



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Malignant Mesothelioma

- Arises from mesothelial cells of pleura, pericardium, and peritoneum
- Often associated with asbestos exposure (10 -15%)
- Frequently affects men with a median age at presentation of 60 years.
- Imaging findings
  - Peritoneal nodularity and omental caking
  - Calcified peritoneal plates are rare
  - Classified into two types.
    - *Wet type*: diffuse sheet-like thickening of the peritoneum with widespread nodules and ascites.
    - *Dry type*: localized soft tissue masses with little ascites

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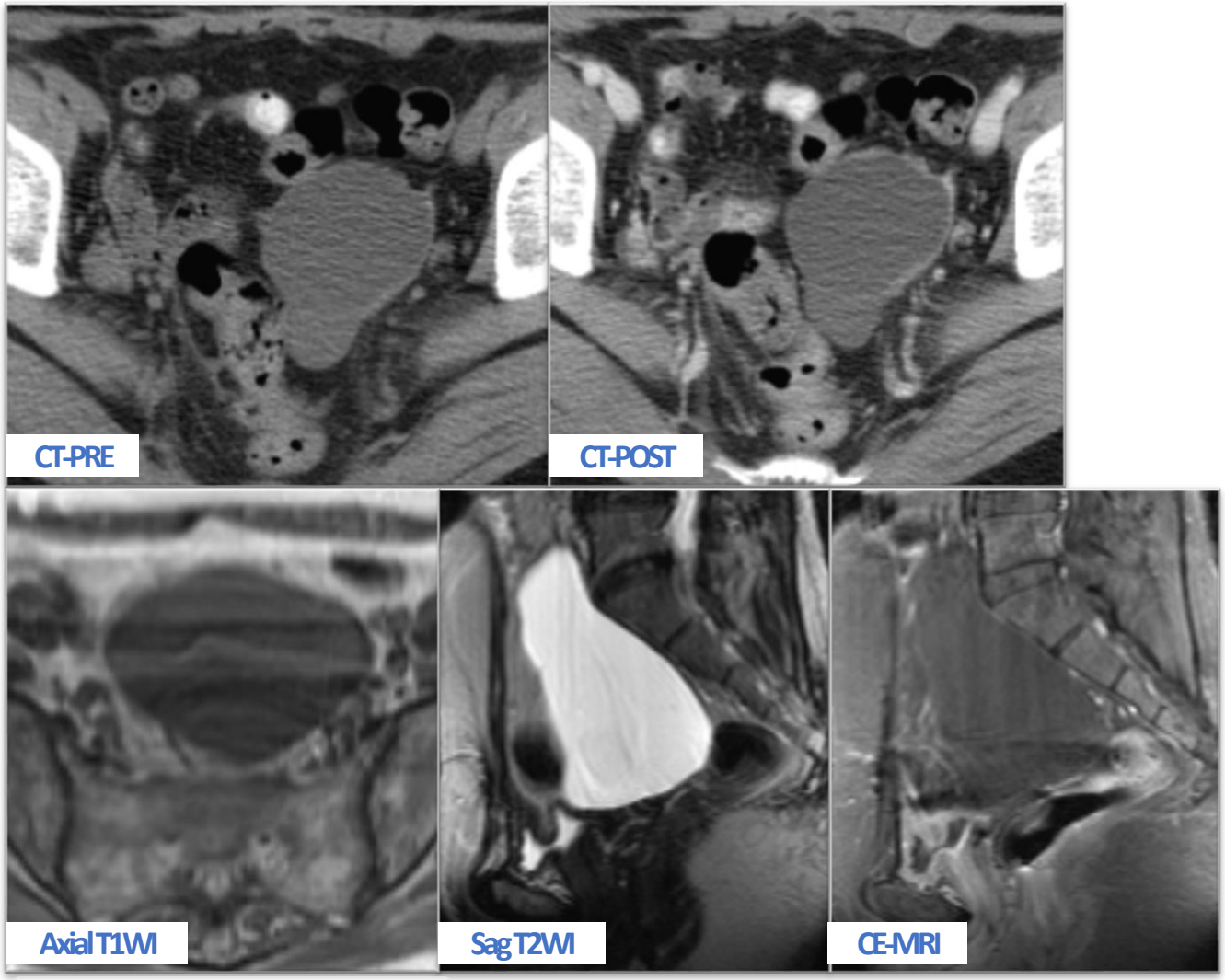
What is the most likely diagnosis ?



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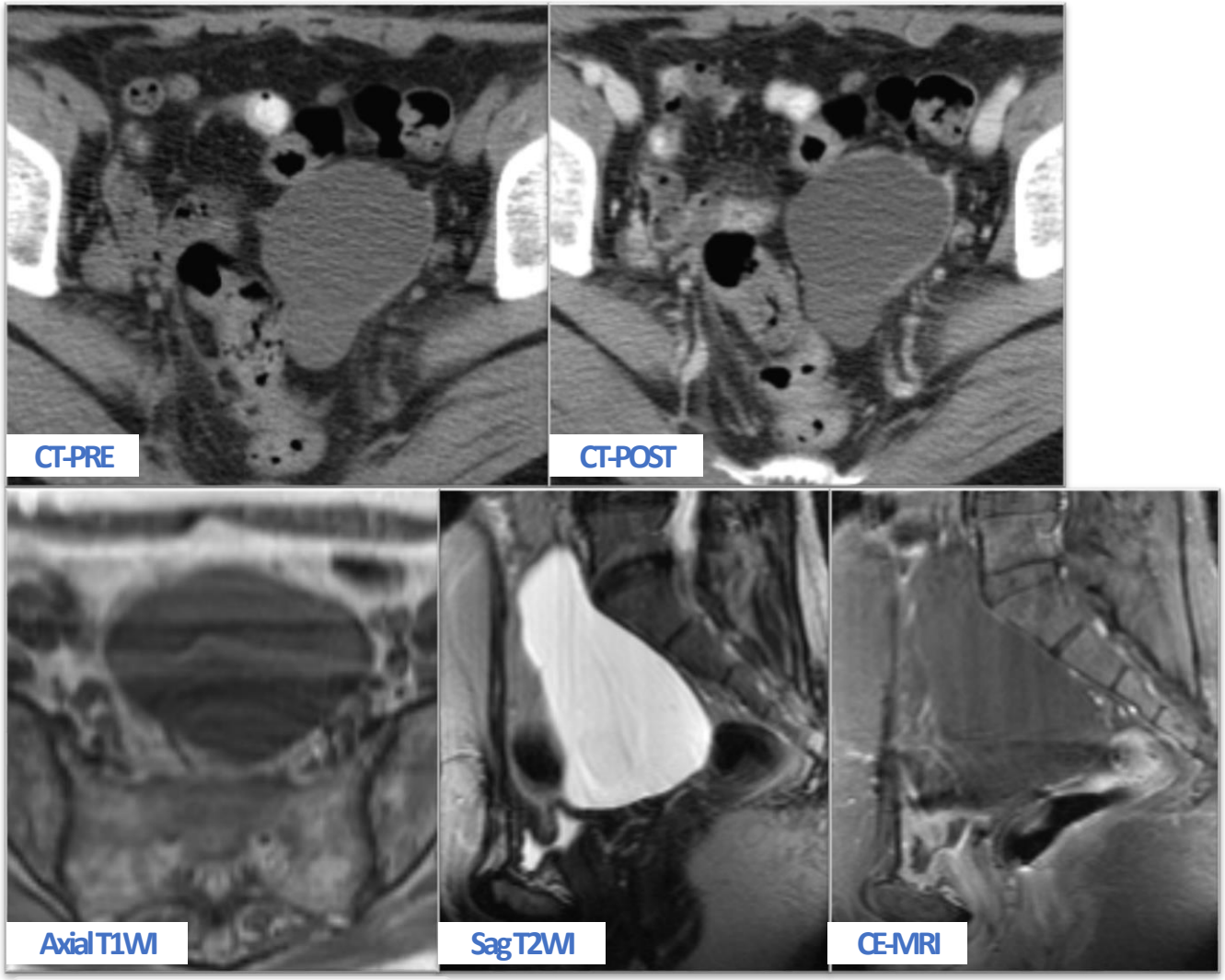
Peritoneal Inclusion Cyst



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Benign cystic peritoneal mesothelioma (Peritoneal inclusion cyst)

- Benign cystic peritoneal mesothelioma = peritoneal inclusion cyst, multilocular inclusion cyst, multicystic mesothelioma
- A non-neoplastic reactive mesothelial proliferation, formed by interaction of an active ovary and peritoneal adhesions
- Peritoneal fluid formed by exudation from an active ovary and entrapped by peritoneal adhesion

  → ***women of reproductive age***

- Imaging findings:
  - A well-defined, non-calcified cystic mass around ovary
  - Spider web pattern due to multi-loculated cystic mass with enhancing internal septa formed to fibrous tissue
  - *Entrapped ovary within accumulation of peritoneal fluid*

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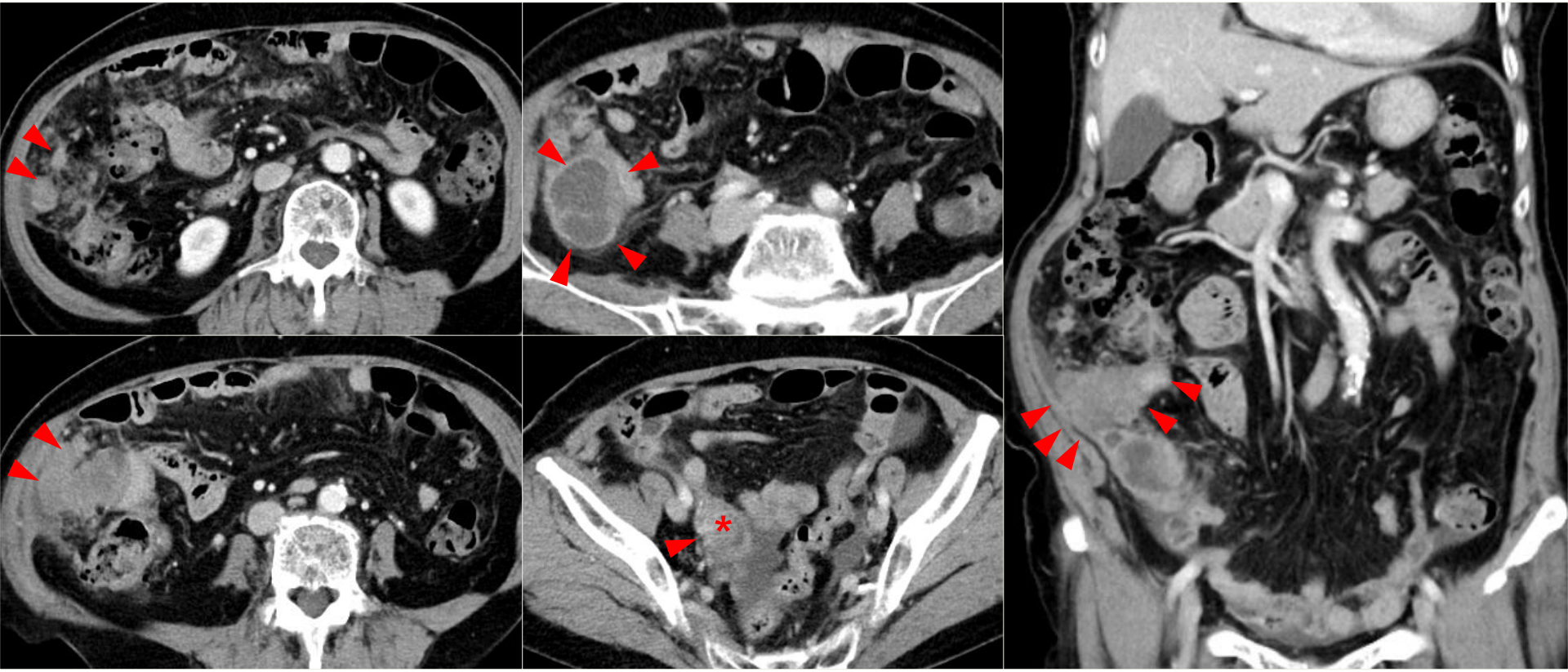
What is the most likely diagnosis ?



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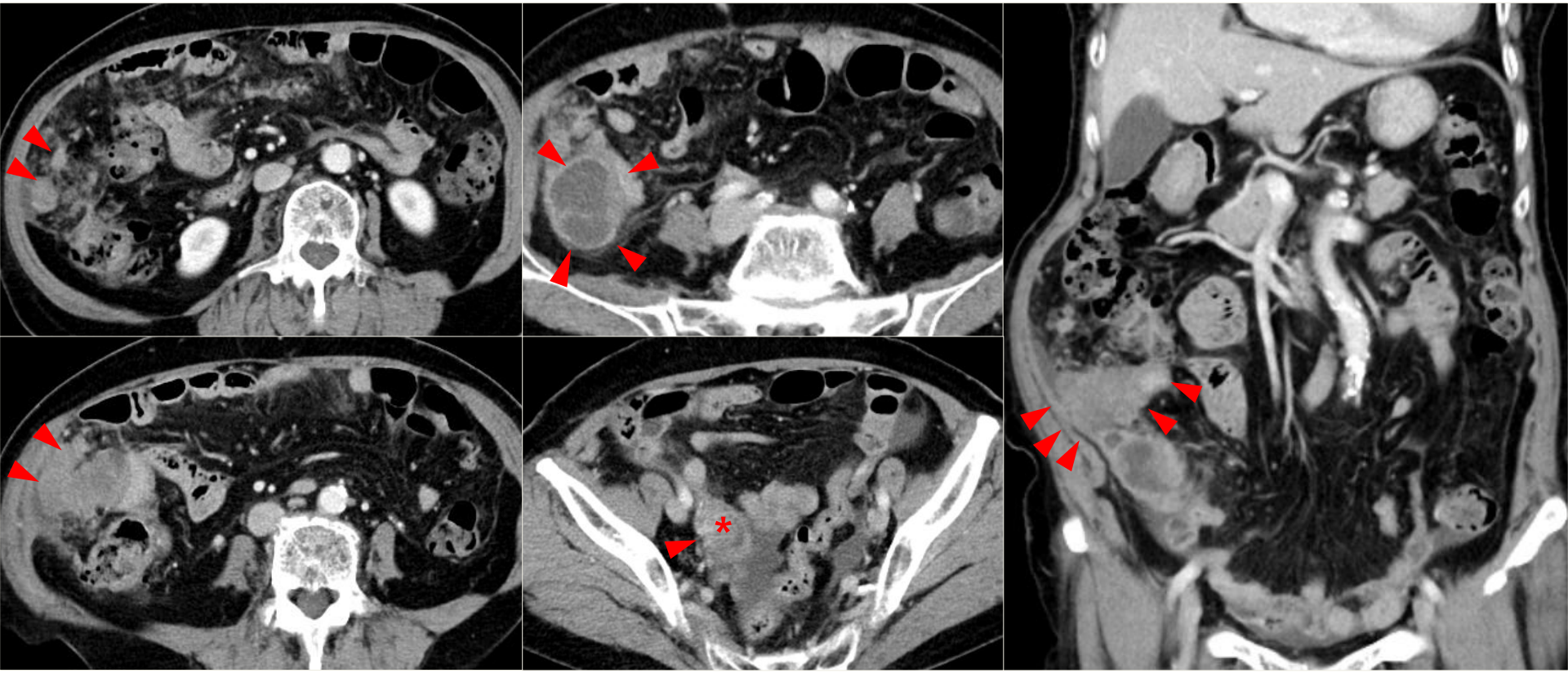
Primary Peritoneal Papillary Serous Carcinoma



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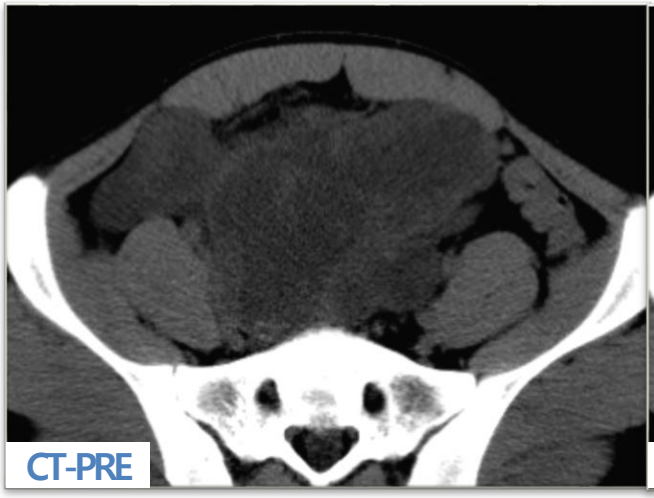
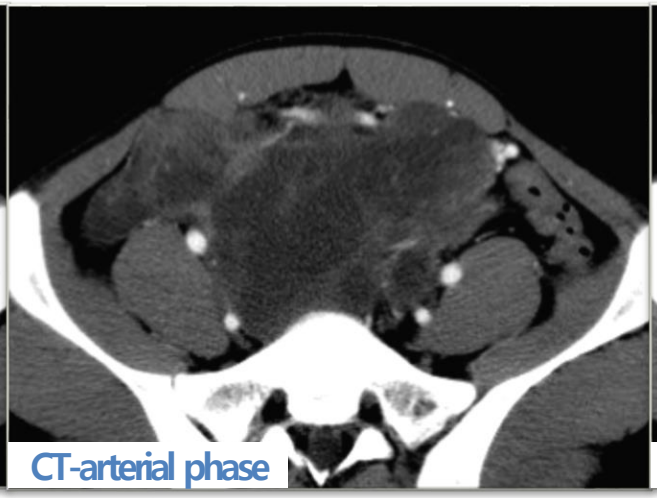
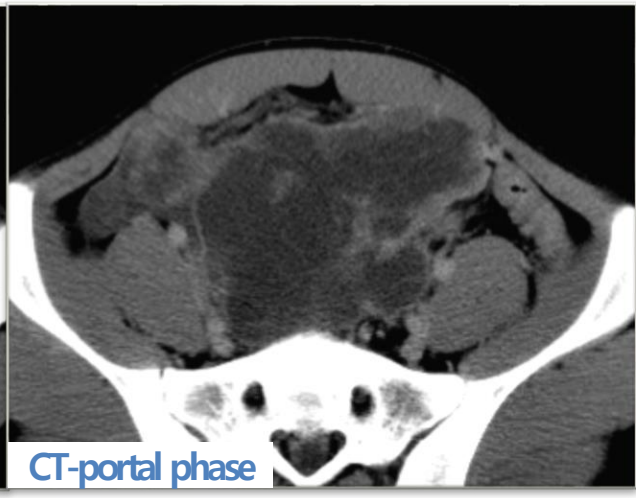
Primary Peritoneal Papillary Serous Carcinoma

- Rare epithelial tumor that arises from the peritoneum
- Postmenopausal women
- Difficult to differentiate from ovarian epithelial stromal tumor.
- The following criteria favors primary peritoneal serous carcinoma:
  - (a) both ovaries are normal
  - (b) the involvement of extraovarian sites must be greater than the involvement on the surface of either ovary
  - (c) the ovarian involvement is limited to the ovarian surface epithelium, either without stromal invasion or involving the cortical stroma with tumor size less than 5 x 5mm.
- Imaging findings
  - Ascites
  - Diffuse peritoneal thickening with nodules and masses
  - Peritoneal and omental nodules may show calcification
  - Woman with no evidence of a visceral primary or ovarian mass

What is the most likely diagnosis ?







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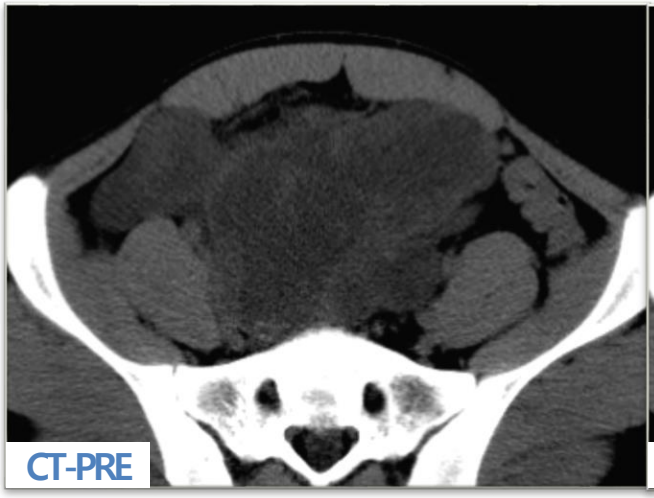
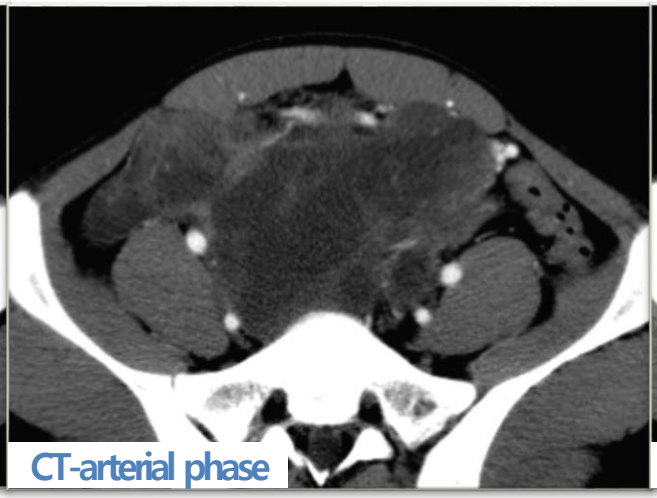
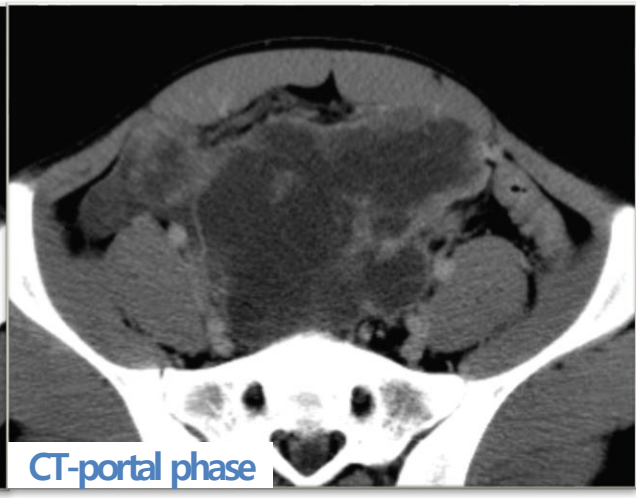
Desmoplastic Small Round Cell Tumor







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Desmoplastic Small Round Cell Tumor

- One of “small round blue cell tumor” family, belongs to the family of primitive pediatric tumors that are composed of small, round, blue cells with Wilms tumor, Ewing sarcoma, and peripheral primitive neuroectodermal tumor
- Common in children to young male
- Rare but highly aggressive neoplasm arising from the mesothelium of serosa.
- Anywhere in the intraperitoneal space, however, paravesical space is frequently involved.
- Imaging findings
  - multiple large soft tissue masses showing heterogeneous enhancement
  - punctuate calcification, hemorrhage, or necrosis
  - ascites, metastases

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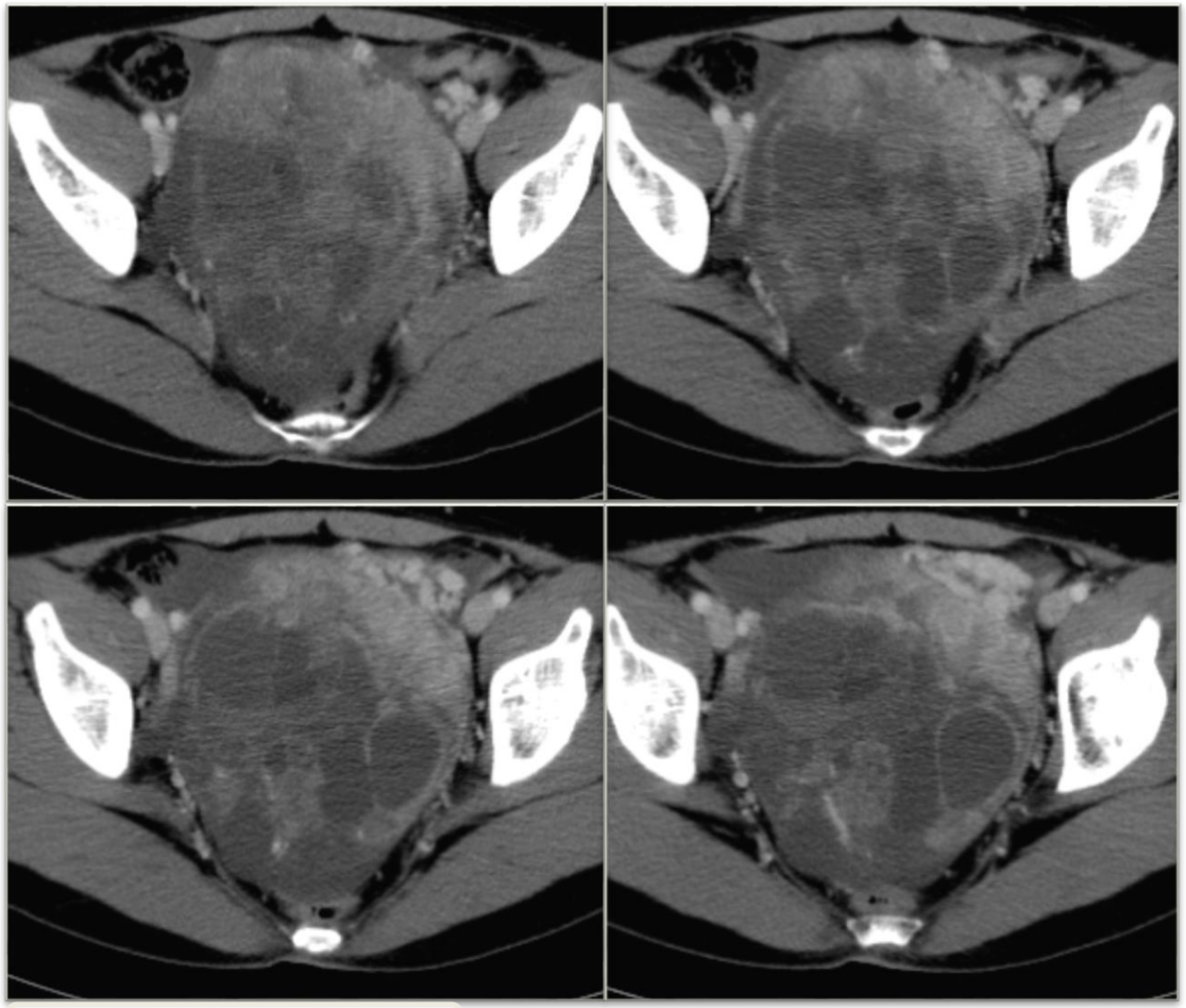
What is the most likely diagnosis ?



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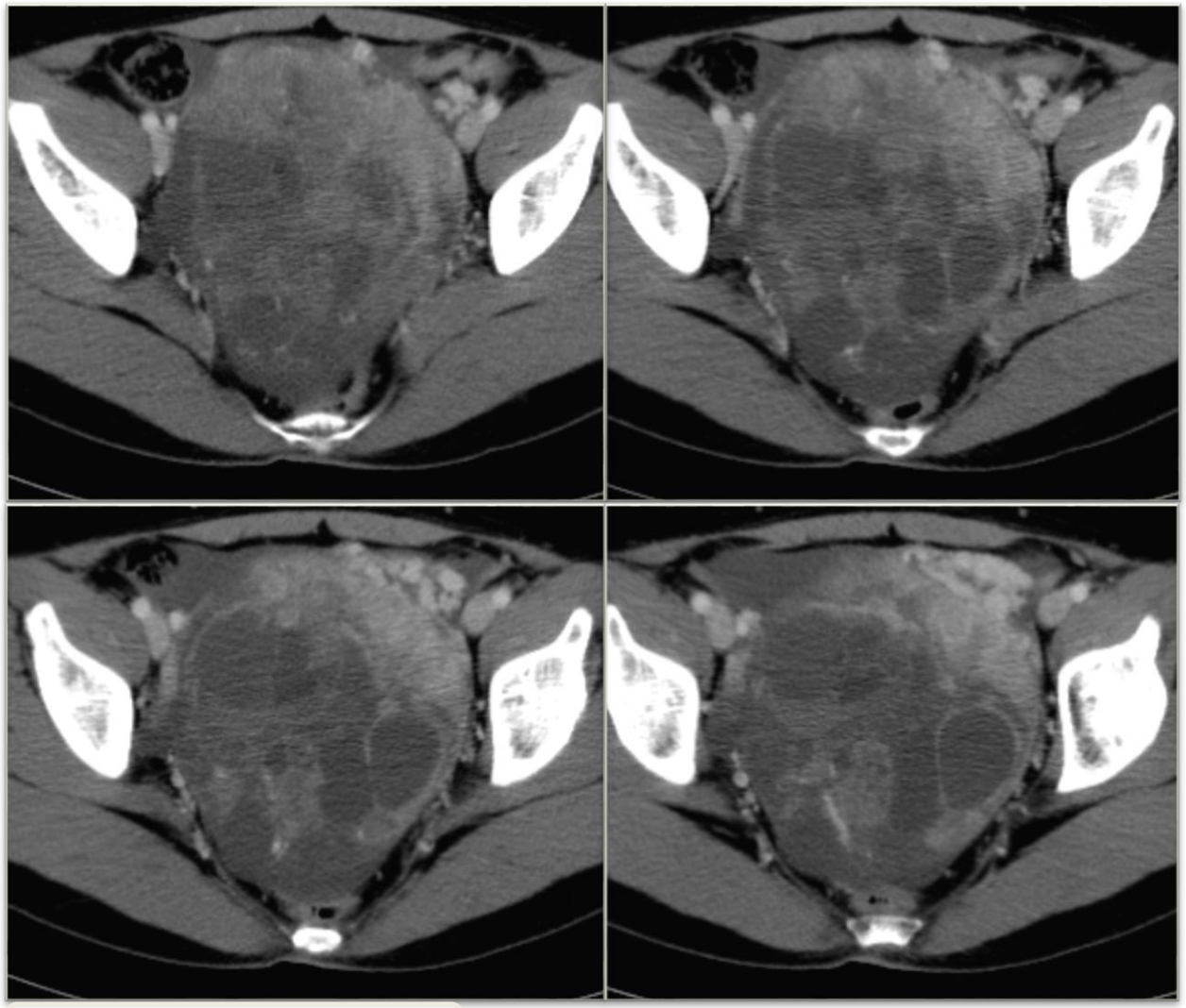
Primitive Neuroectodermal Tumor



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Primitive Neuroectodermal Tumor

- Uncommon, accounting for 1% of all sarcomas
- Adolescents, young adults
- One of small round cell tumor family, composed of small undifferentiated neuroectodermal cells, considered including neuroblastoma, Ewing's sarcoma, rhabdomyosarcoma, and desmoplastic small round cell tumor.
- Highly aggressive and very poor prognosis
- Imaging findings:
  - bulky, heterogeneous enhancing mass
  - Very invasive, necrotic and hemorrhagic features

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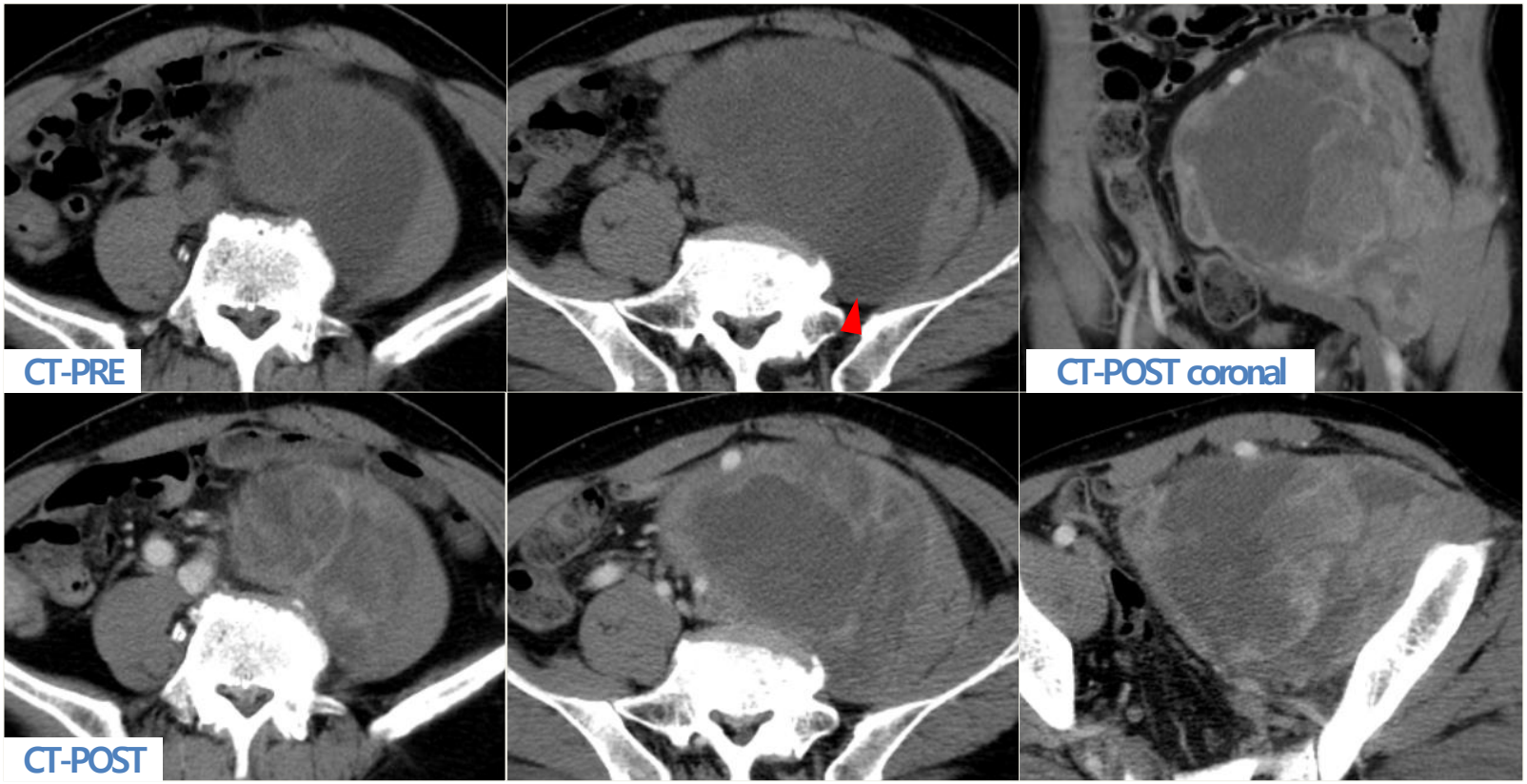
What is the most likely diagnosis ?



A 53-year-old male

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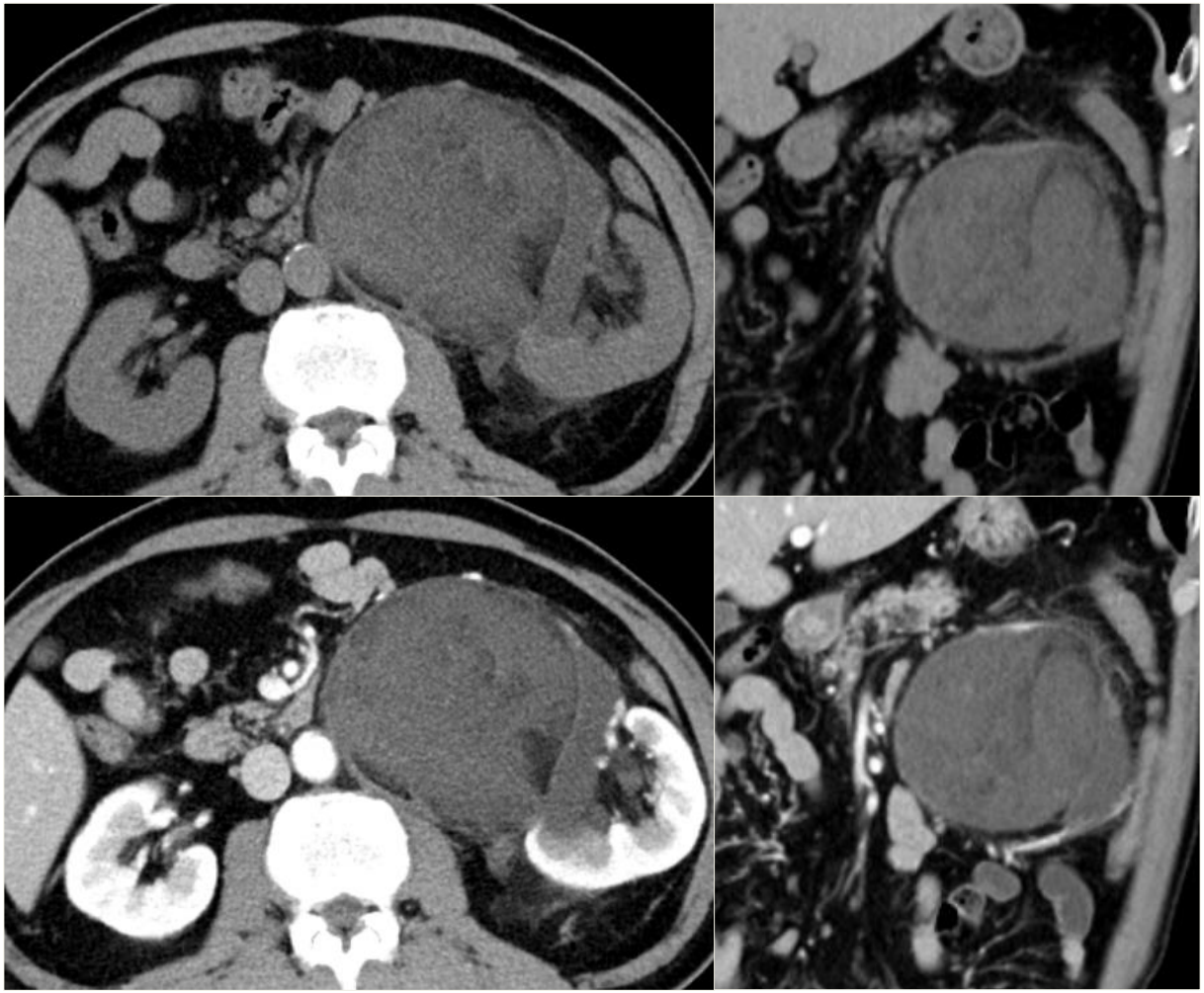
Liposarcoma



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Liposarcoma

- Liposarcoma classified into four subtypes
  - Well-differentiated type (most common)
  - Myxoid type
  - Pleomorphic type
  - Round cell type
- Large and slowly growing
- Imaging findings
  - predominantly hypoattenuation on CT (fat content)
  - thick, irregular, and nodular septa with enhancement
  - heterogeneous attenuation with calcification in 30%

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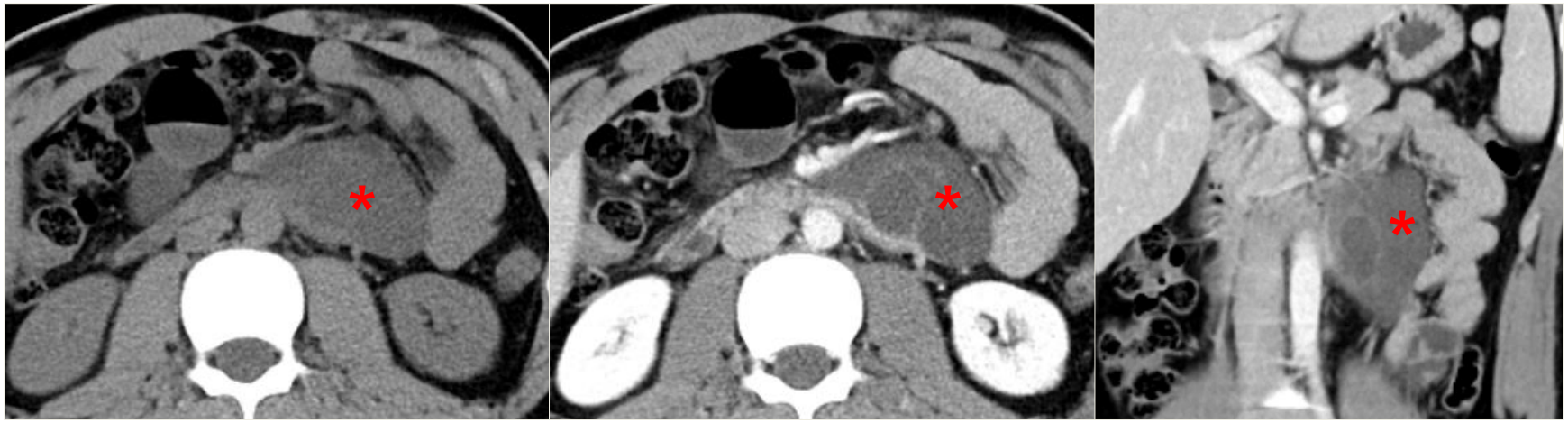
What is the most likely diagnosis ?



A 20-year-old male

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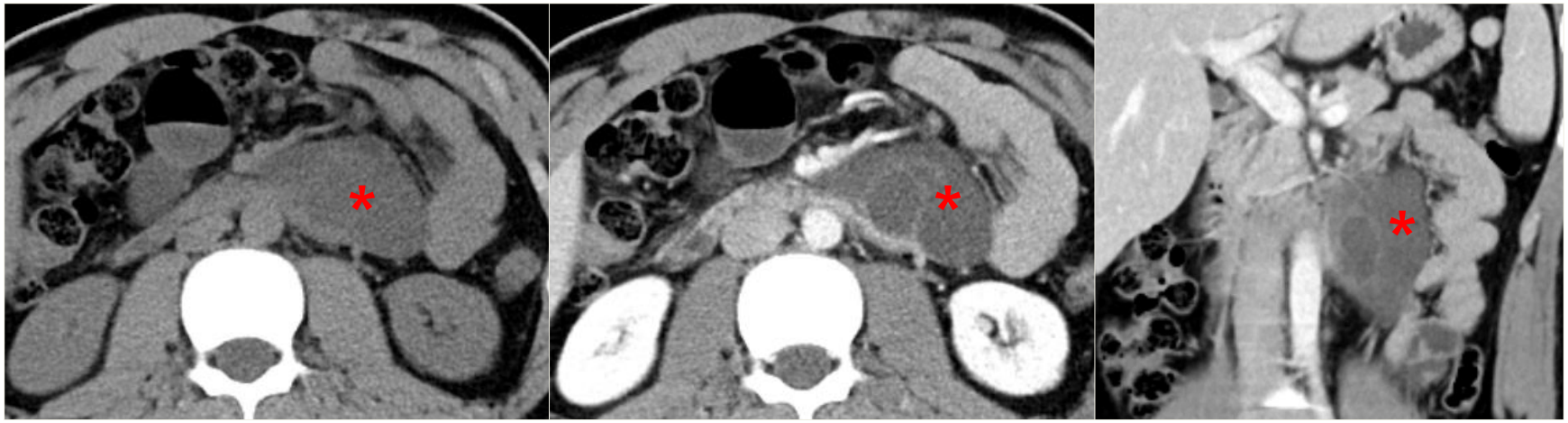
Lymphangioma



A 20-year-old male

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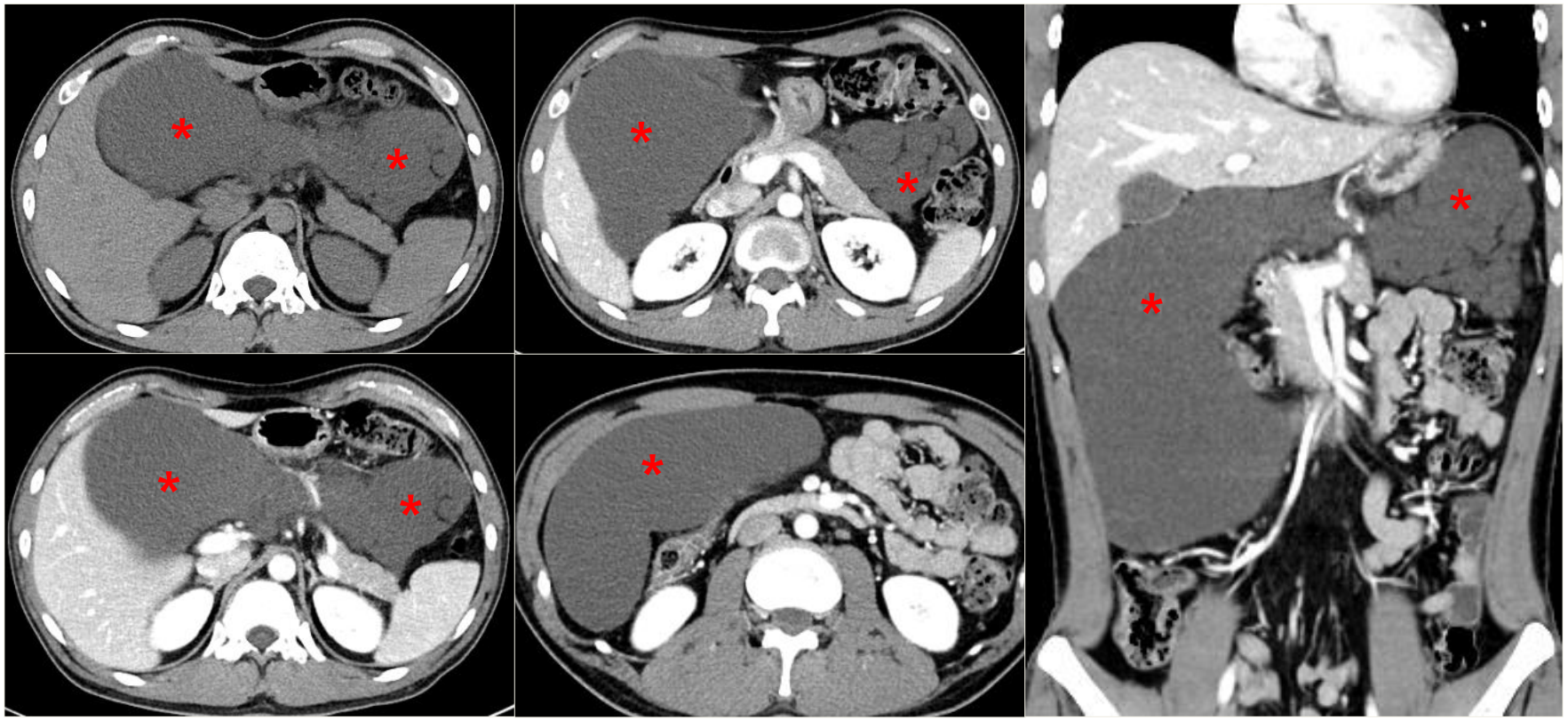
Lymphangioma



A 20-year-old male

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Lymphangioma

- Developmental malformation
- Thin-walled unilocular or multilocular cysts lined with a single endothelial layer containing clear or milky fluid
- Imaging findings
  - thin-walled unilocular or multilocular cystic mass
  - variable attenuation: negative attenuation (chyle component) to high attenuation (hemorrhagic complication)
  - cyst wall & septa may show enhancement
  - calcification (rare)

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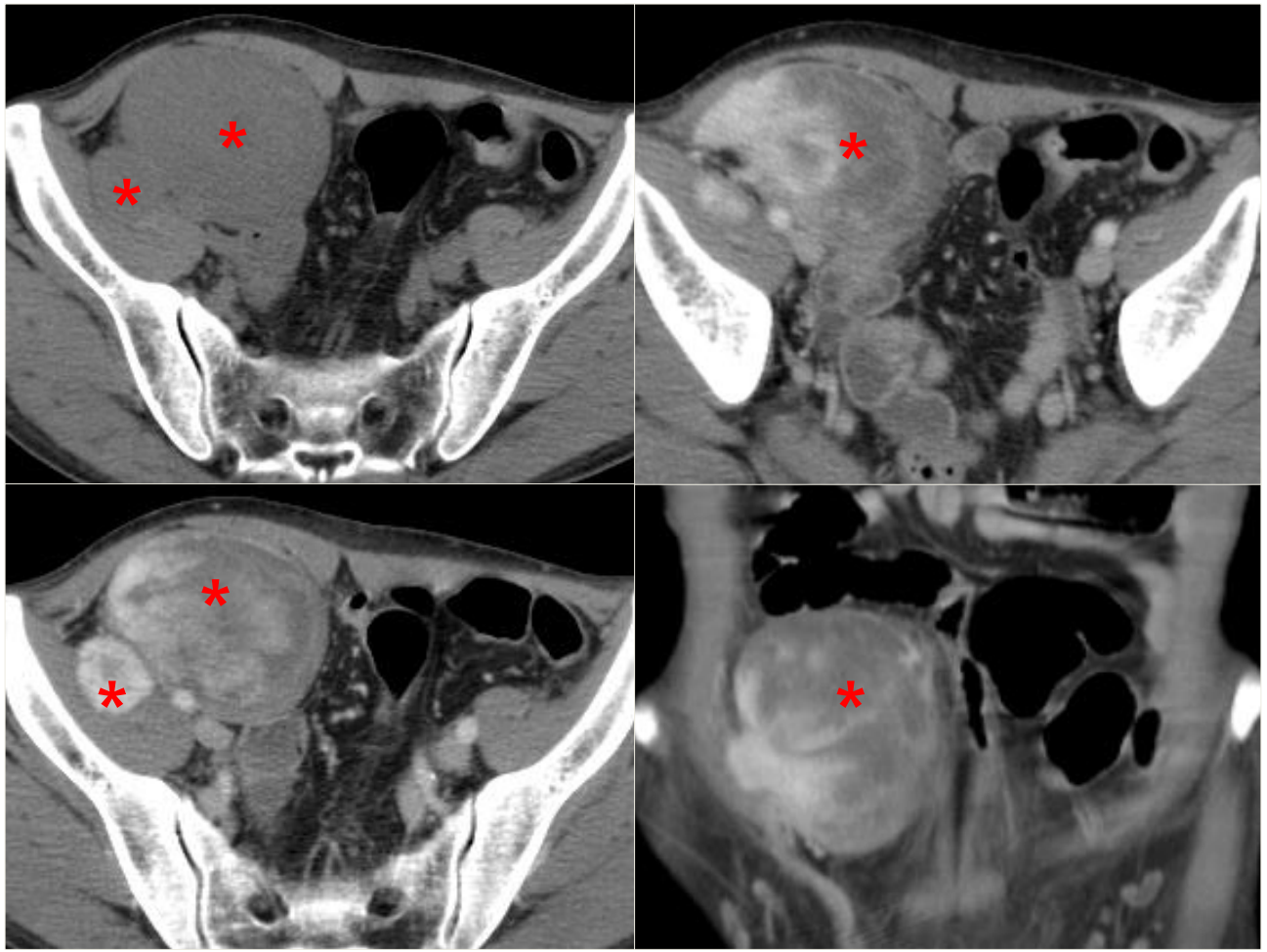
What is the most likely diagnosis ?



A 48-year-old male

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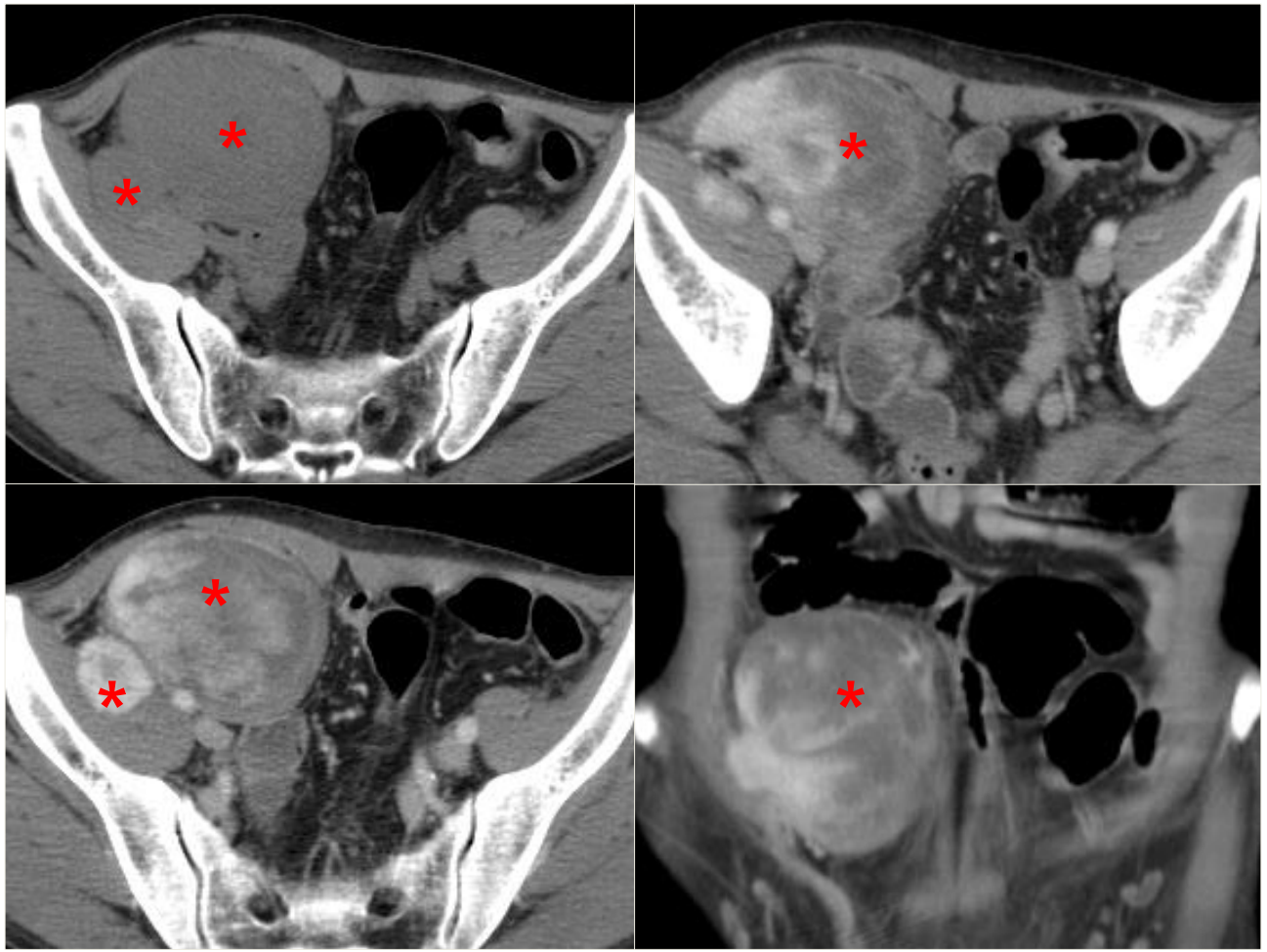
Rhabdomyosarcoma



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Rhabdomyosarcoma

- Rare malignant tumor that arises from the primitive mesenchyme with rhabdomyoma differentiation
- Imaging findings
  - mass showing necrosis and heterogeneous enhancement
  - calcification
  - High-flow blood vessels

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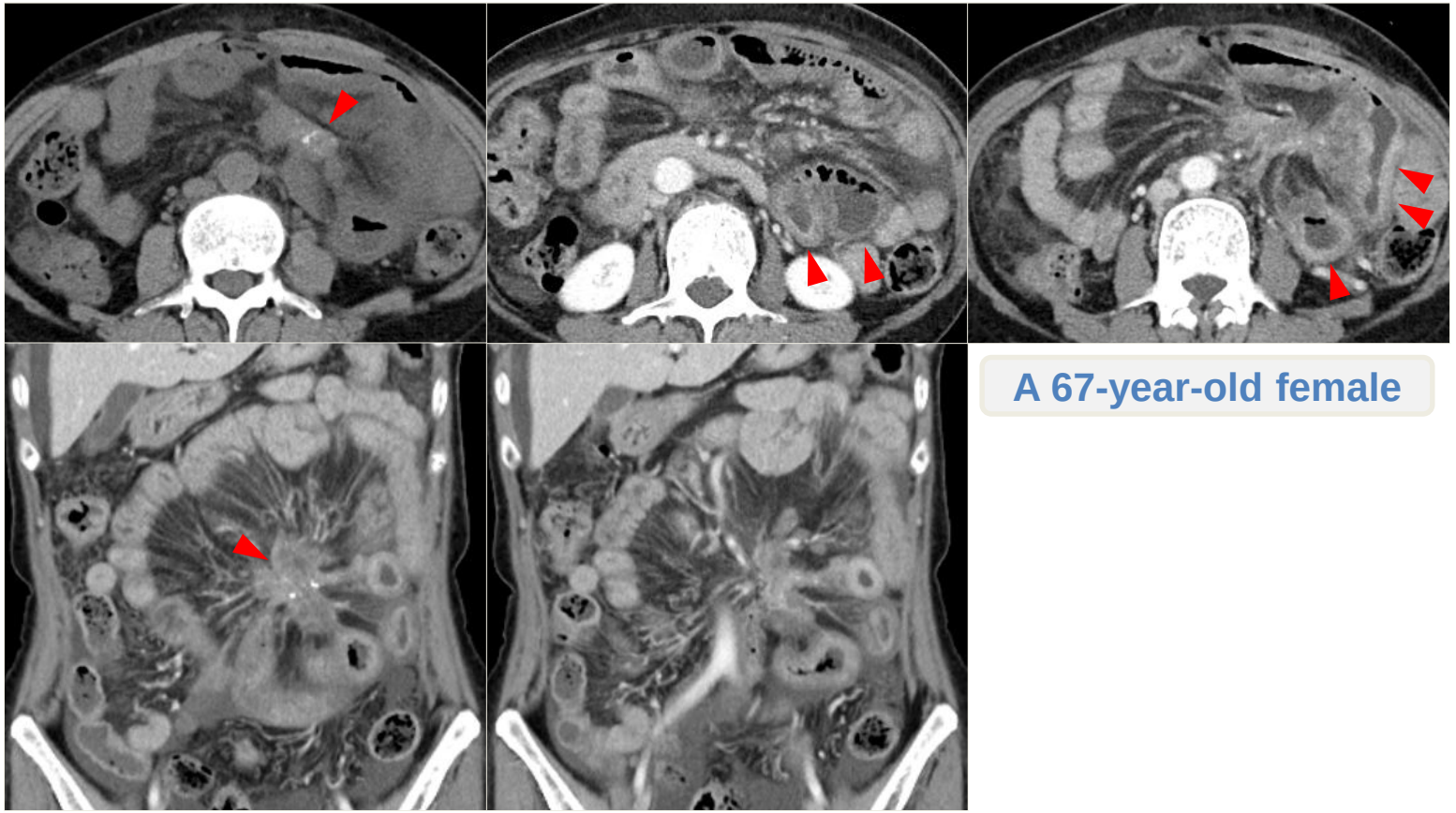
Secondary Peritoneal Neoplasm

What is the most likely diagnosis ?



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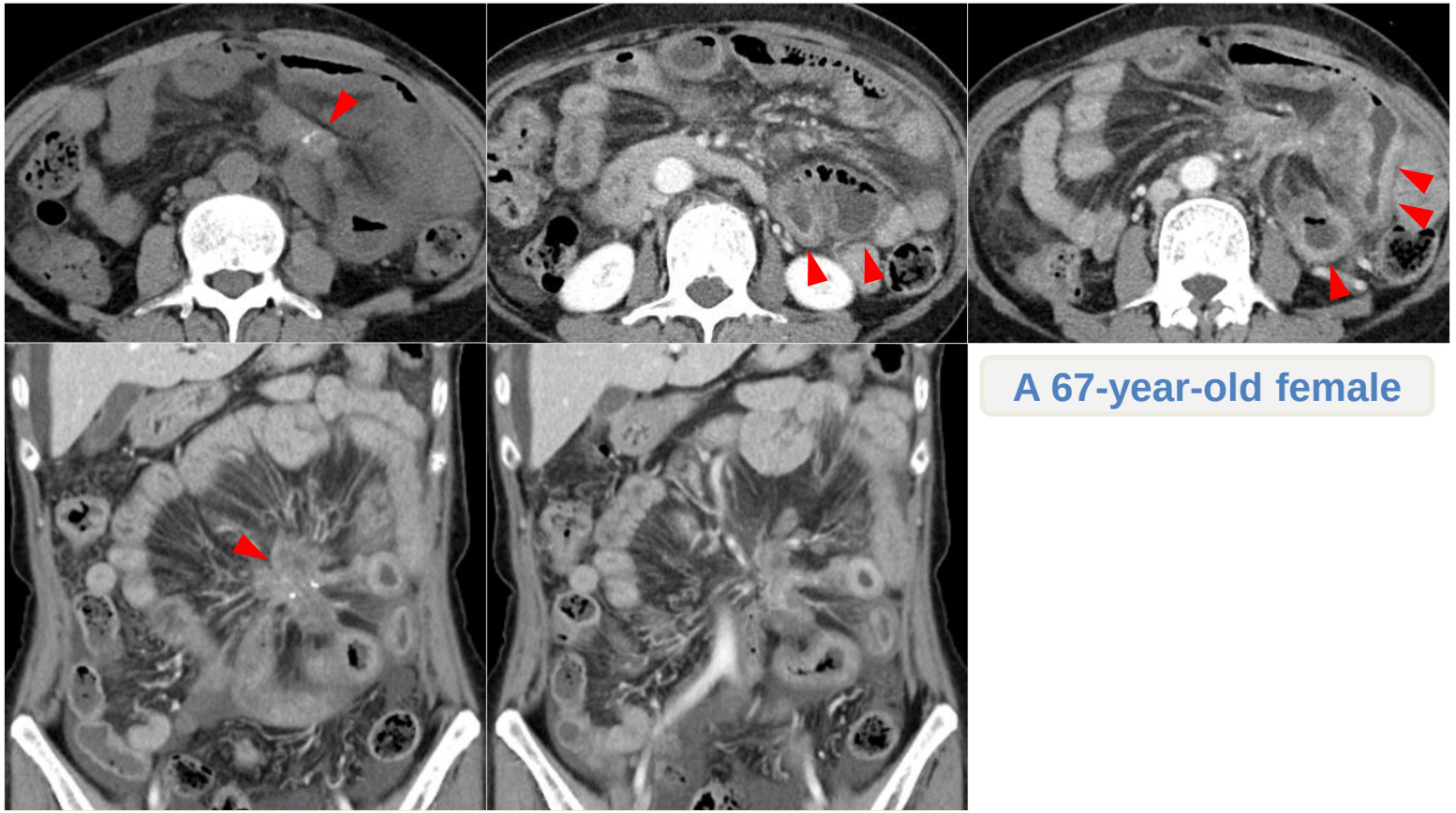
Carcinoid



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Carcinoid (direct spread into peritoneum)

- Carcinoid tumors originate in the intestines
- It shows secondary spread to the mesentery by direct extension or lymphatic spread.
- The primary intestinal mass (most common in distal ileum) is usually difficult to detect, and often the mesenteric tumor is observed.
- Imaging findings
  - enhancing soft tissue mass with linear bands radiating in the mesenteric fat.
  - intense fibrotic proliferation and desmoplastic reaction
  - thickening of adjacent small bowel loops due to caused tumor infiltration or ischemia owing to sclerosis of mesenteric vessels
  - calcifications are common (70%)

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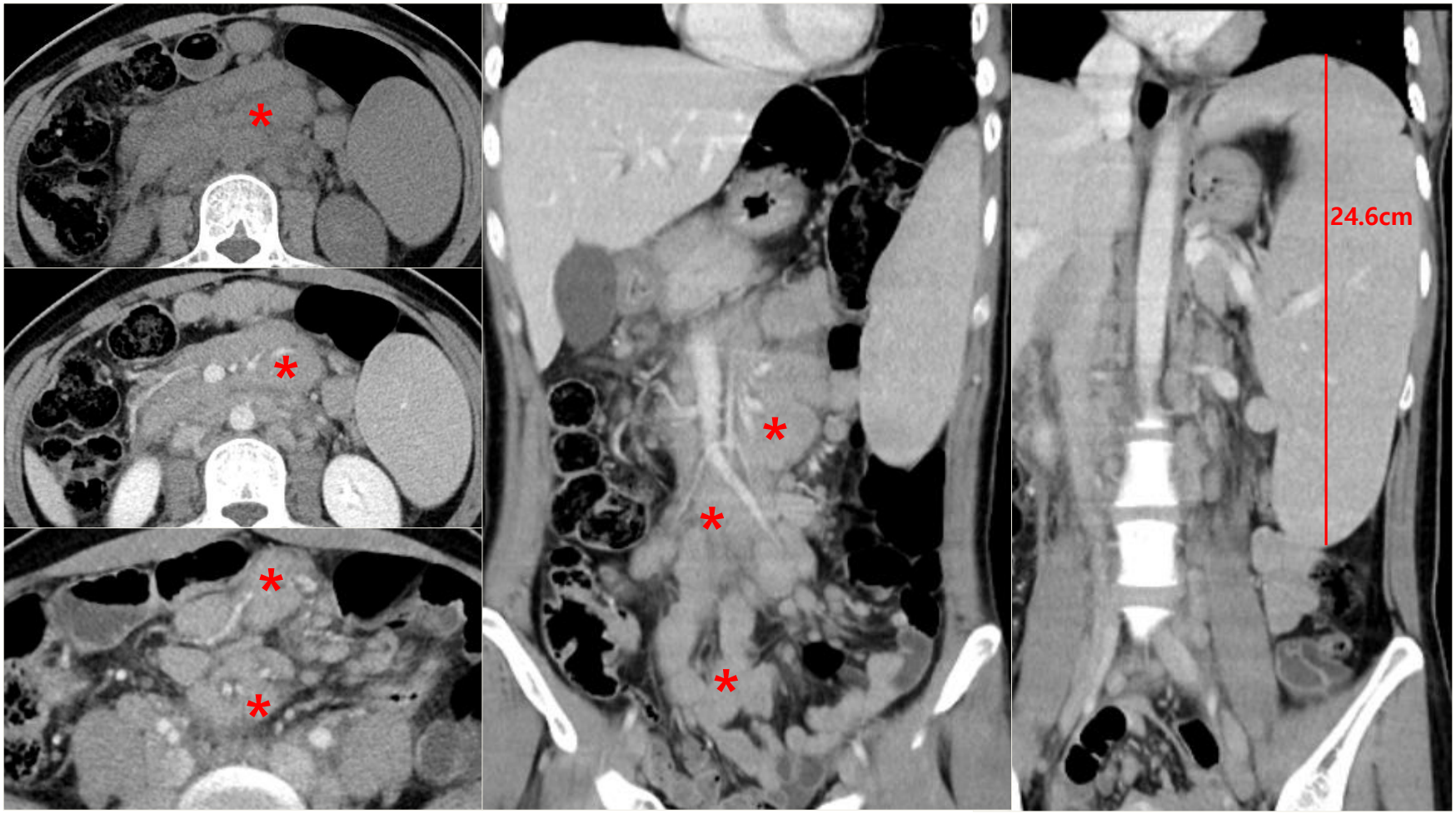
What is the most likely diagnosis ?



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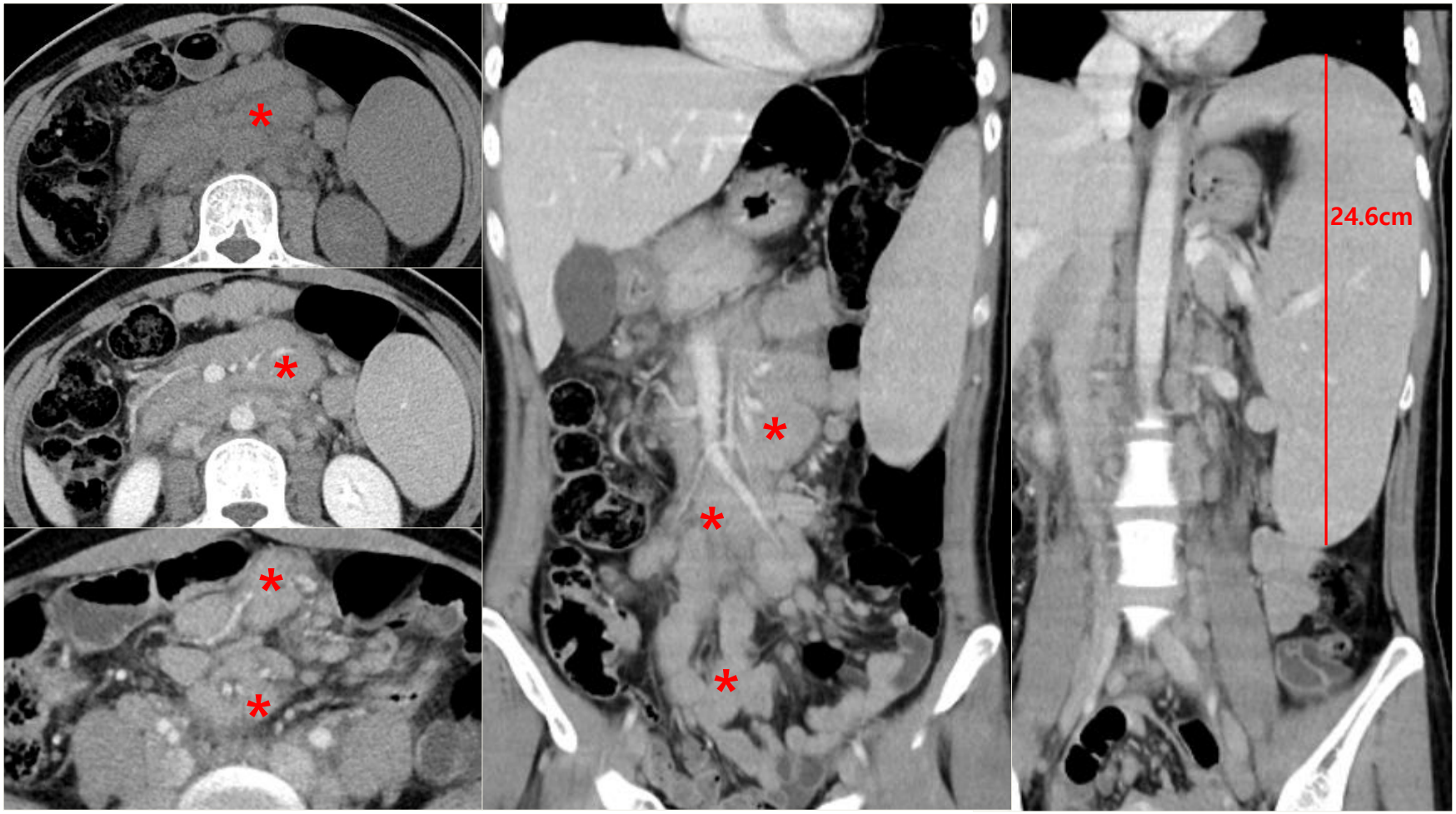
Lymphoma



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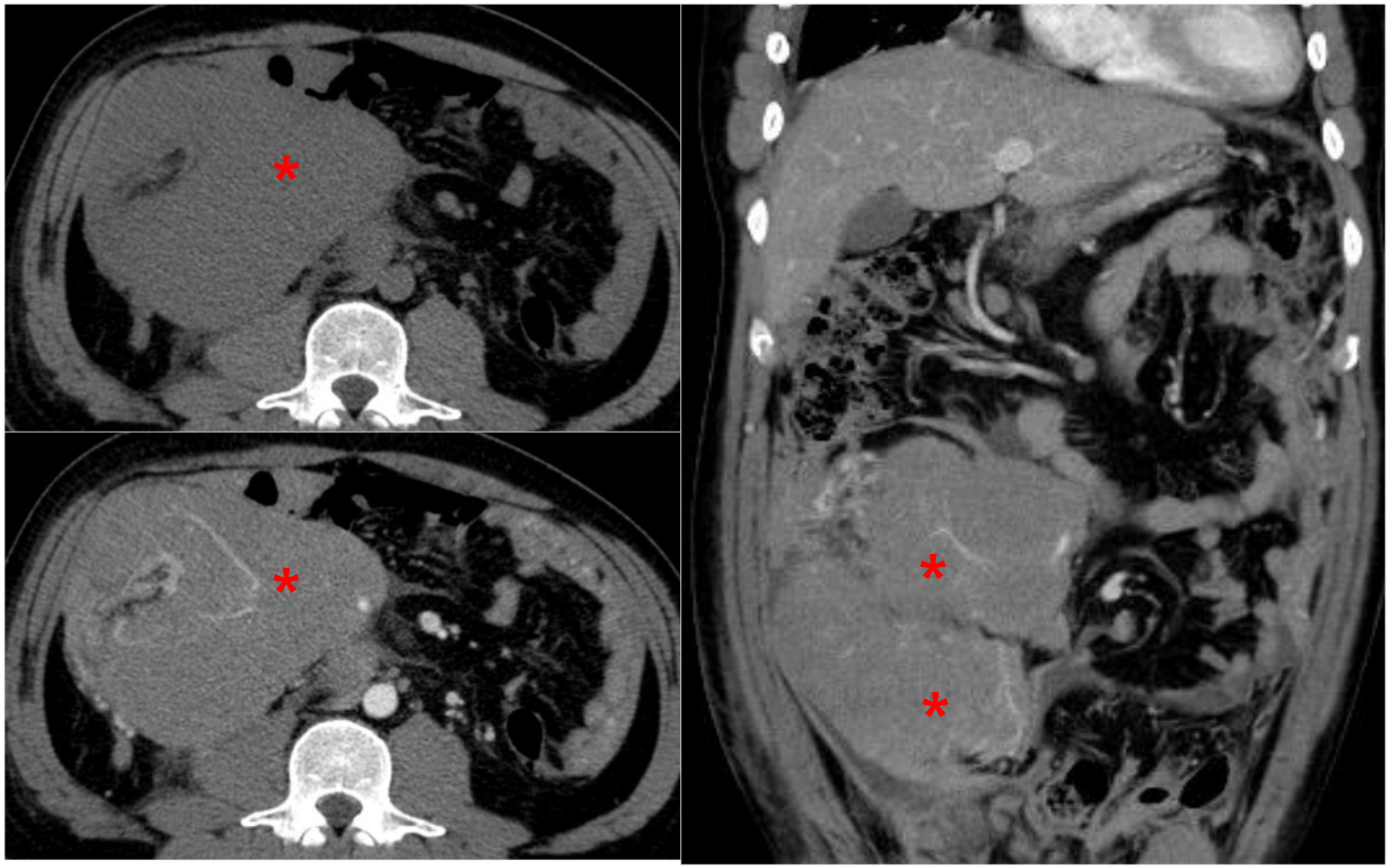
Peritoneal Lymphomatosis



A 38-year-old male

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Lymphatic Dissemination

- Lymphoma is the most common malignant neoplasm affecting the mesentery
  - Non-Hodgkin lymphoma (30-50%)
  - Hodgkin's lymphoma (5%)
- Imaging findings
  - multiple, rounded, mild homogeneous enhancing lymph nodes
  - often encase the mesenteric vessels producing "sandwich sign."
  - a large, lobulated, "cake-like," heterogeneous mass with low attenuation areas of necrosis may displace small bowel loops.
  - enlarged bulky peritoneal and retroperitoneal lymphadenopathy
  - hepatomegaly with or without splenomegaly
- Metastases of colon, ovarian carcinoma, breast, lung cancer, or melanoma may also affect the mesenteric lymph nodes

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Hematogeneous spread

- Hematogeneous metastases of melanoma, breast, or lung often reach the antimesenteric border of small intestine through small mesenteric vessels. Metastases classically manifest as enhancing nodules or as focal thickening of the bowel.
- It can be a leading point for intussusception.

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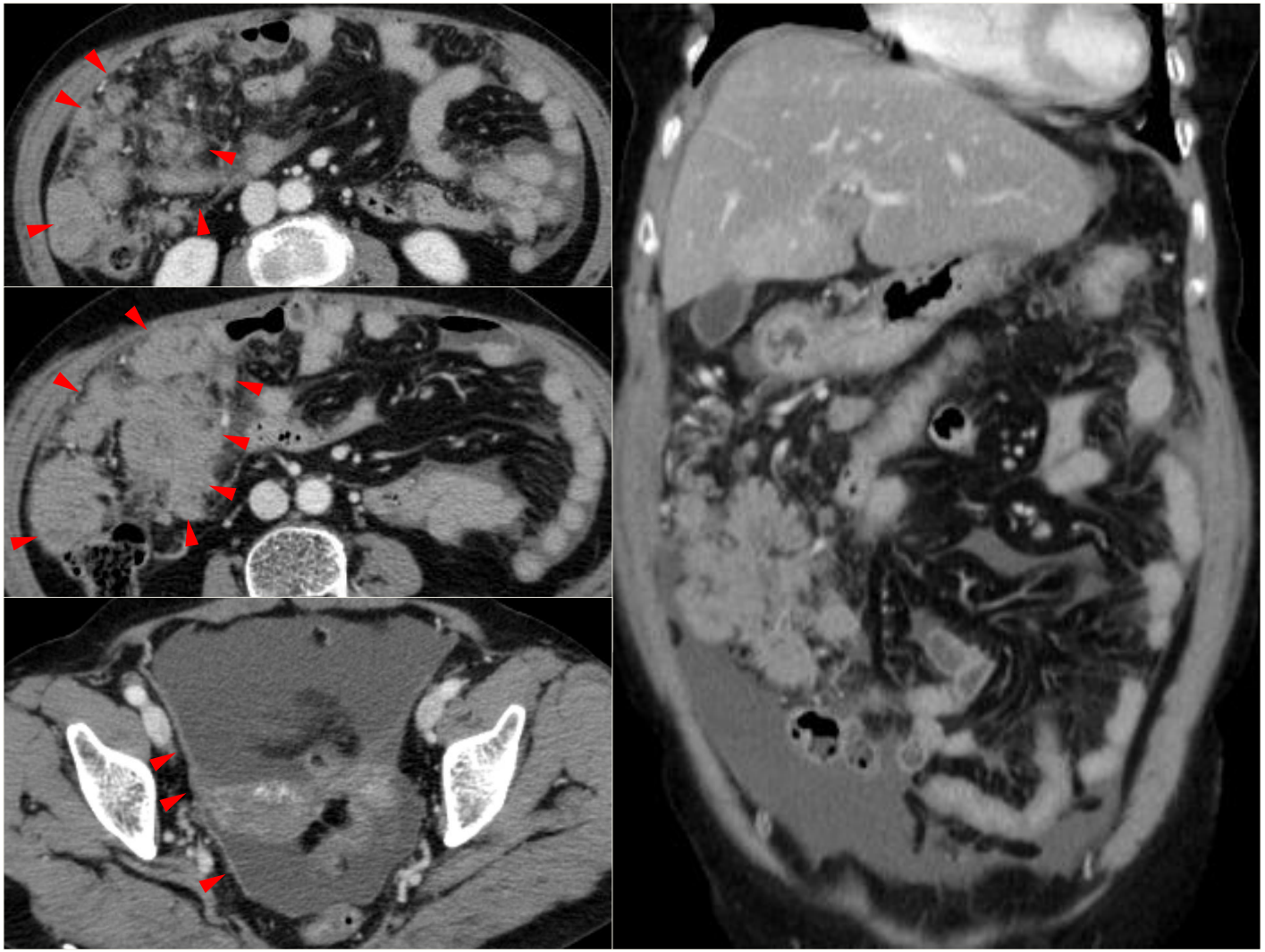
What is the most likely diagnosis ?



A 68-year-old female

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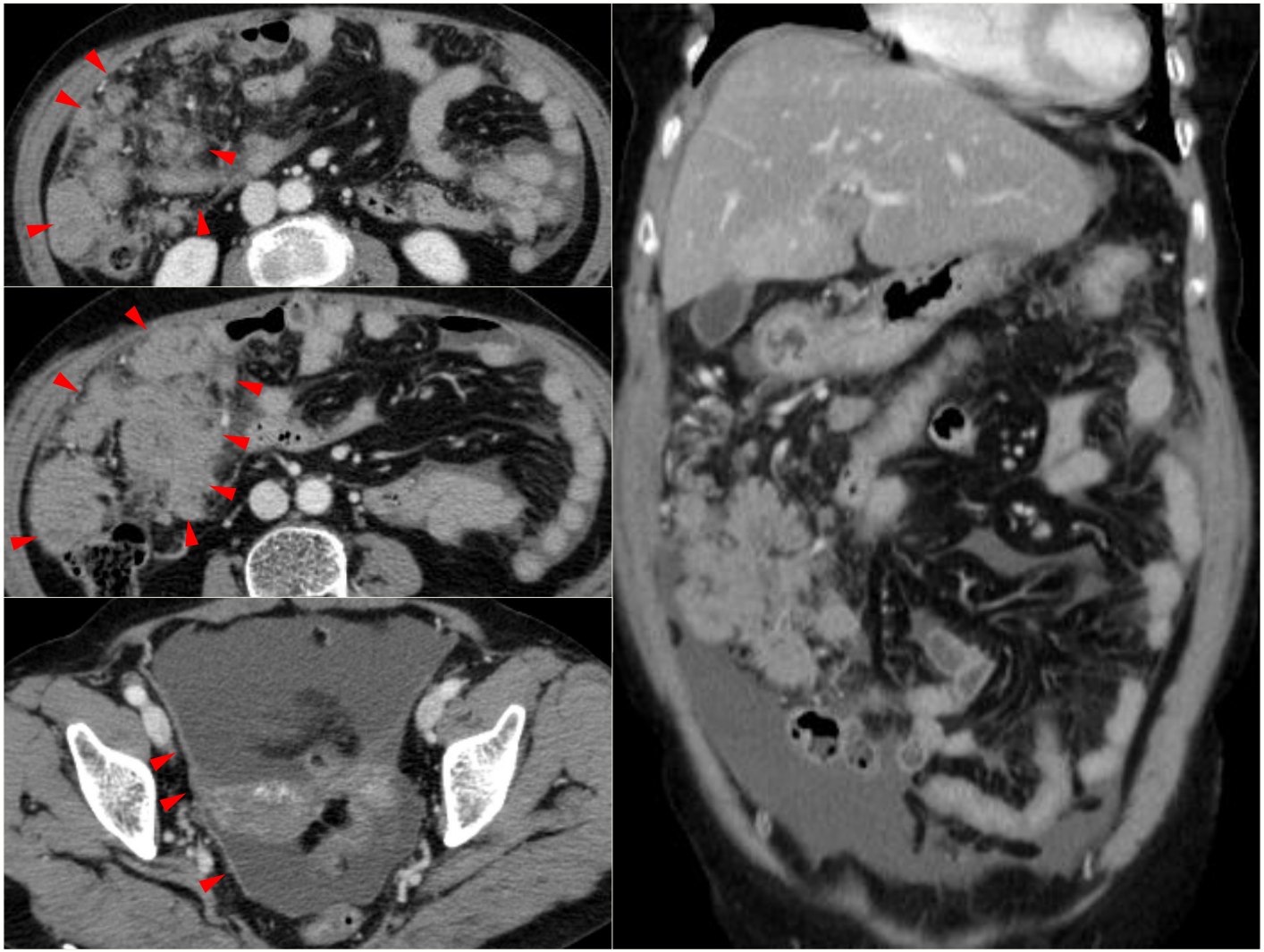
Peritoneal Seeding of Ovary Cancer



A 68-year-old female

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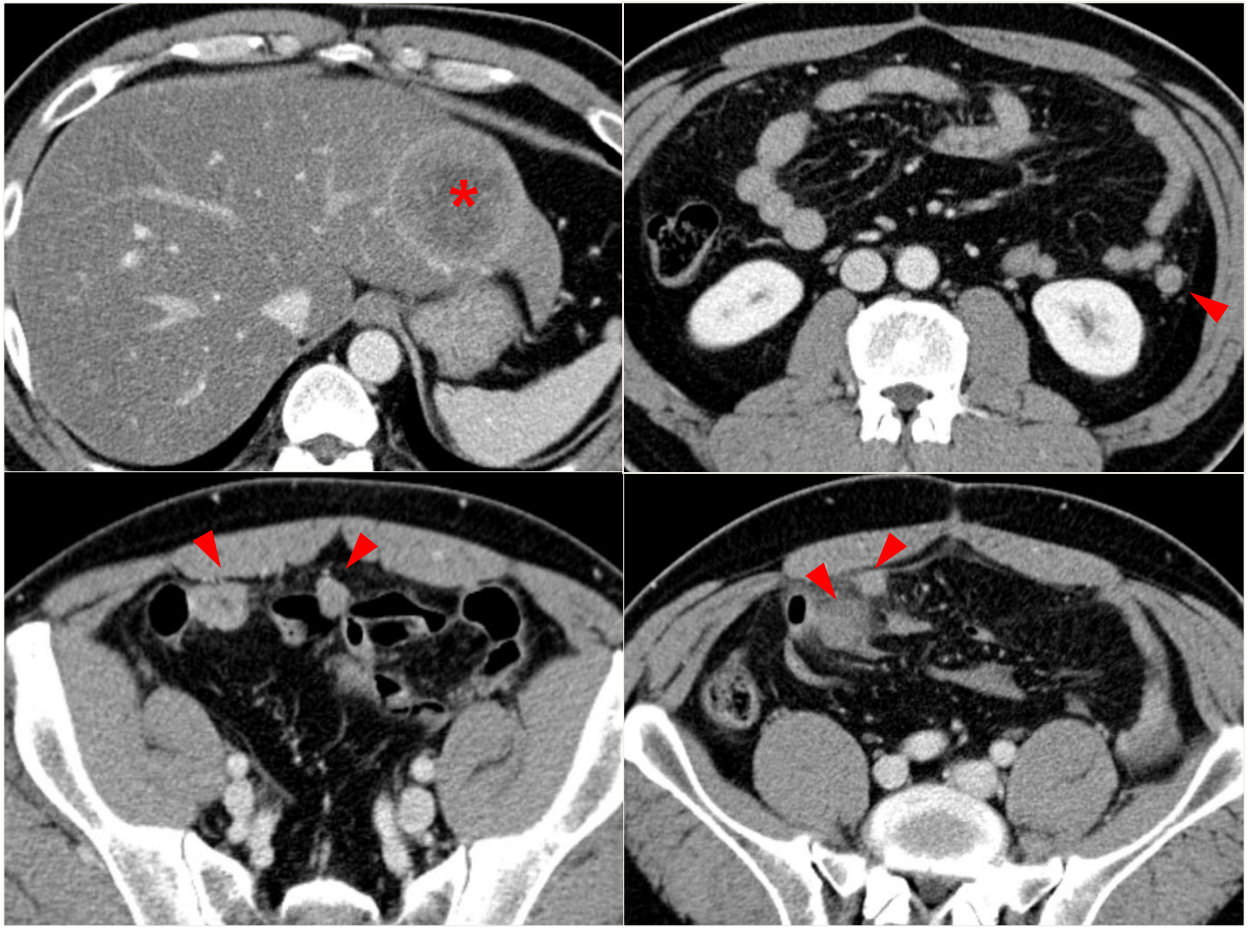
What is the most likely diagnosis ?



A 37-year-old male

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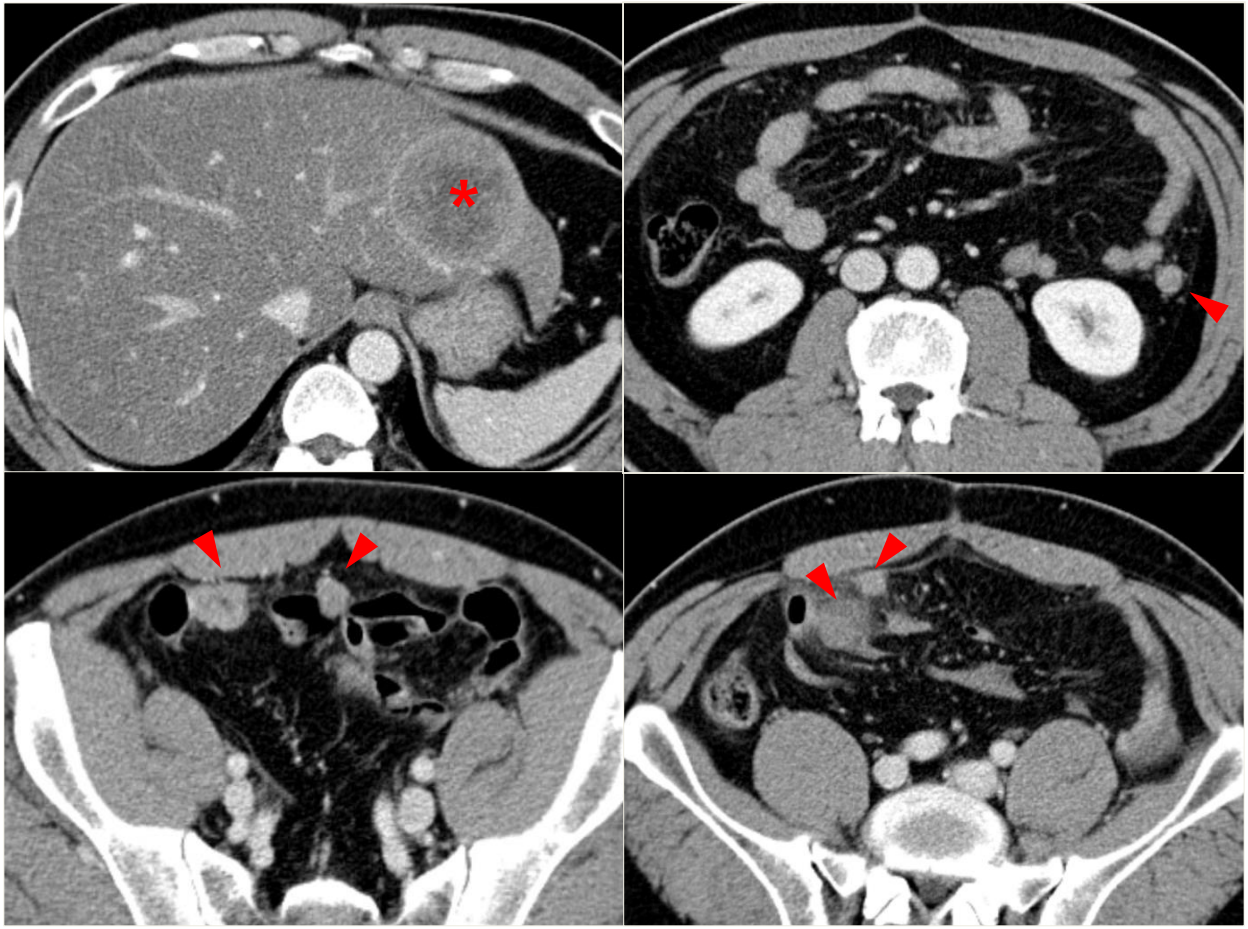
Metastasis of Gastrointestinal Stromal Tumor



A 37-year-old male

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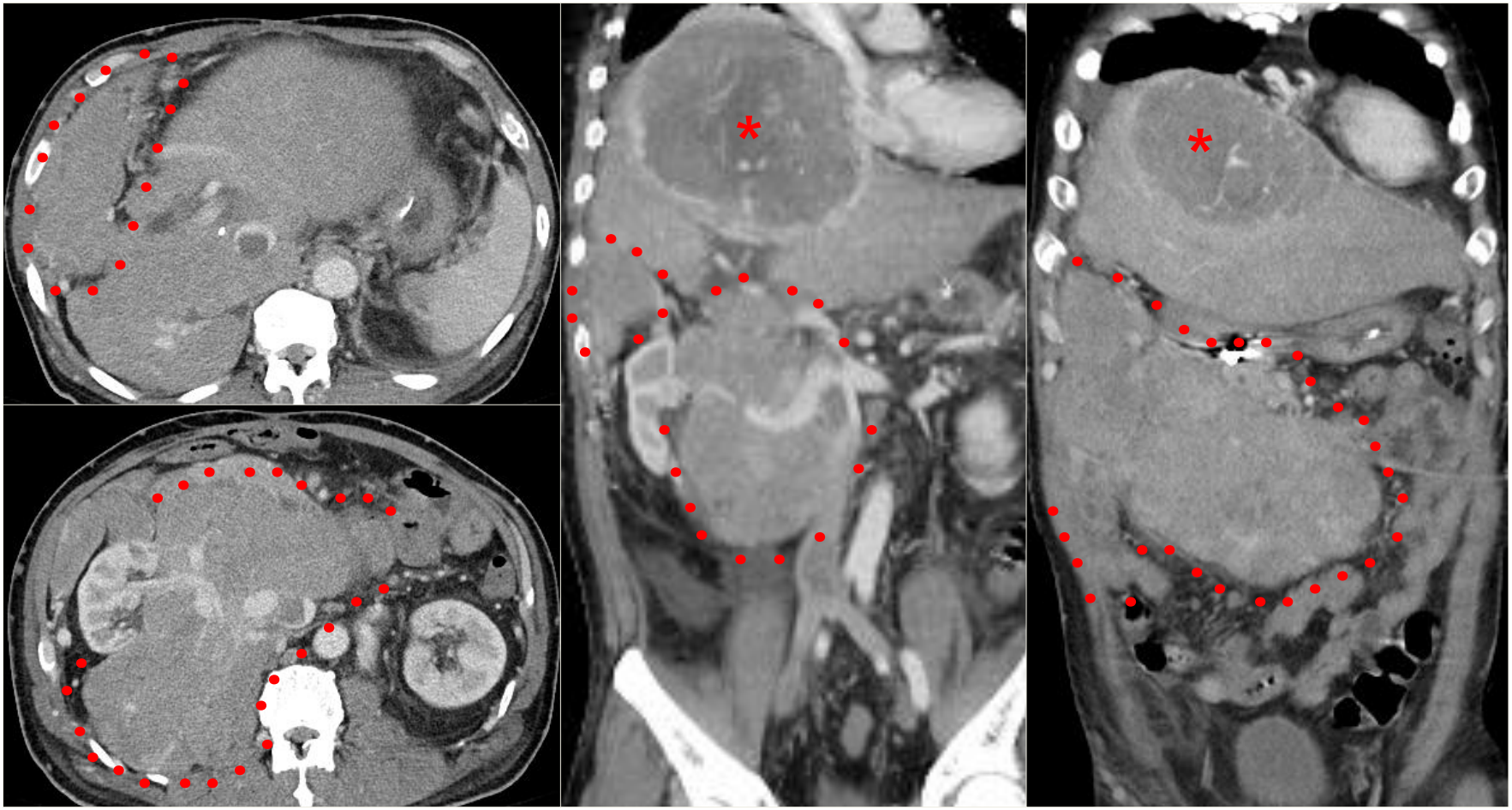
What is the most likely diagnosis ?



A 55-year-old male

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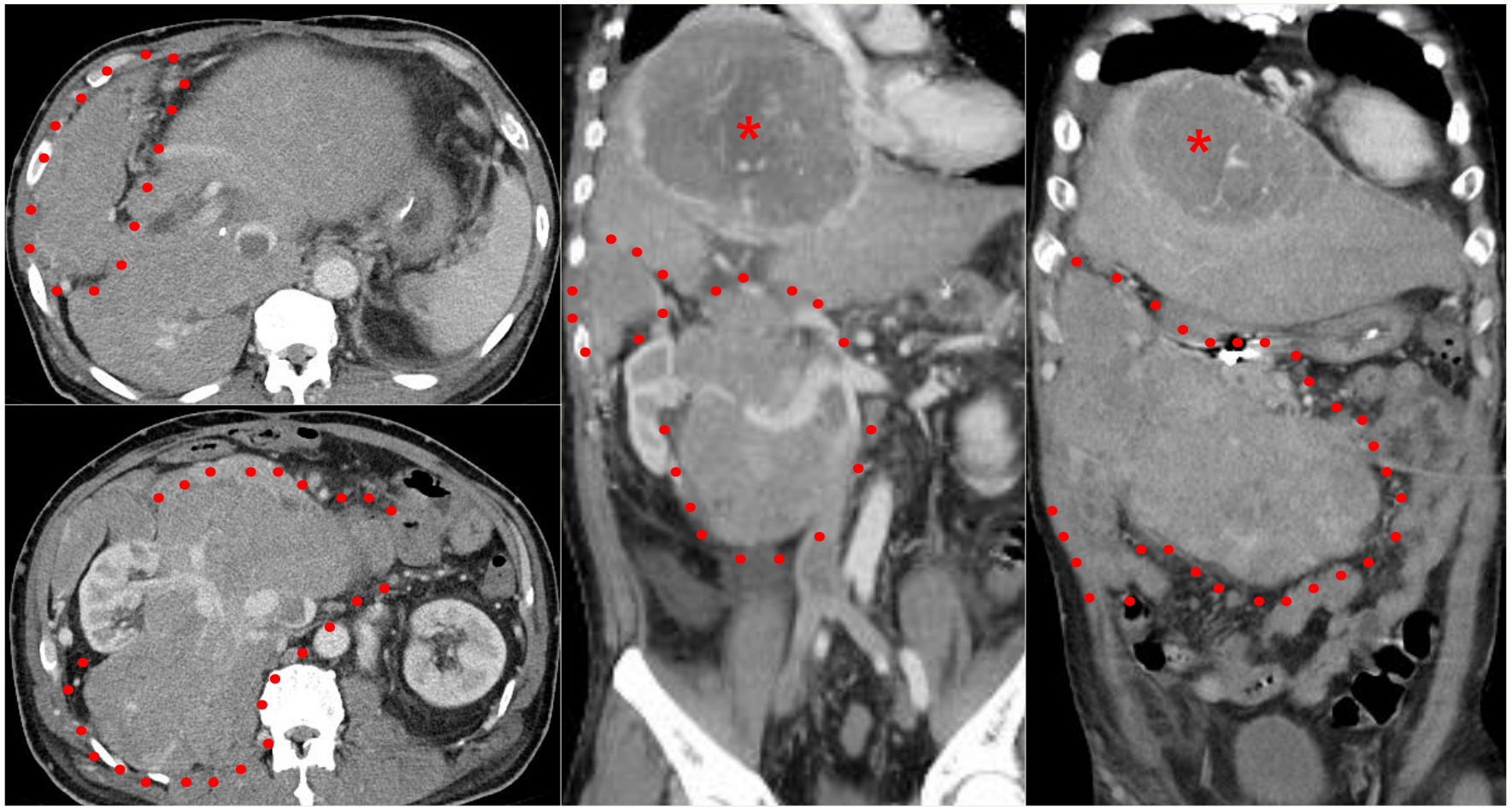
Metastasis of Gastrointestinal Stromal Tumor



A 55-year-old male

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Intraperitoneal Seeding:

Carcinomatosis peritonei from GI tract cancer, ovary & GIST, etc.

- Right lower quadrant mesentery, cul-de sac:

  → course of natural flow of fluid in the peritoneal cavity

  ➔ common site of intraperitoneal tumor seeding

- Imaging features
  - ascites
  - peritoneal thickening
  - focal masses by tumor deposits
  - diffuse infiltration of the mesenteric fat produce so-called stellate appearance

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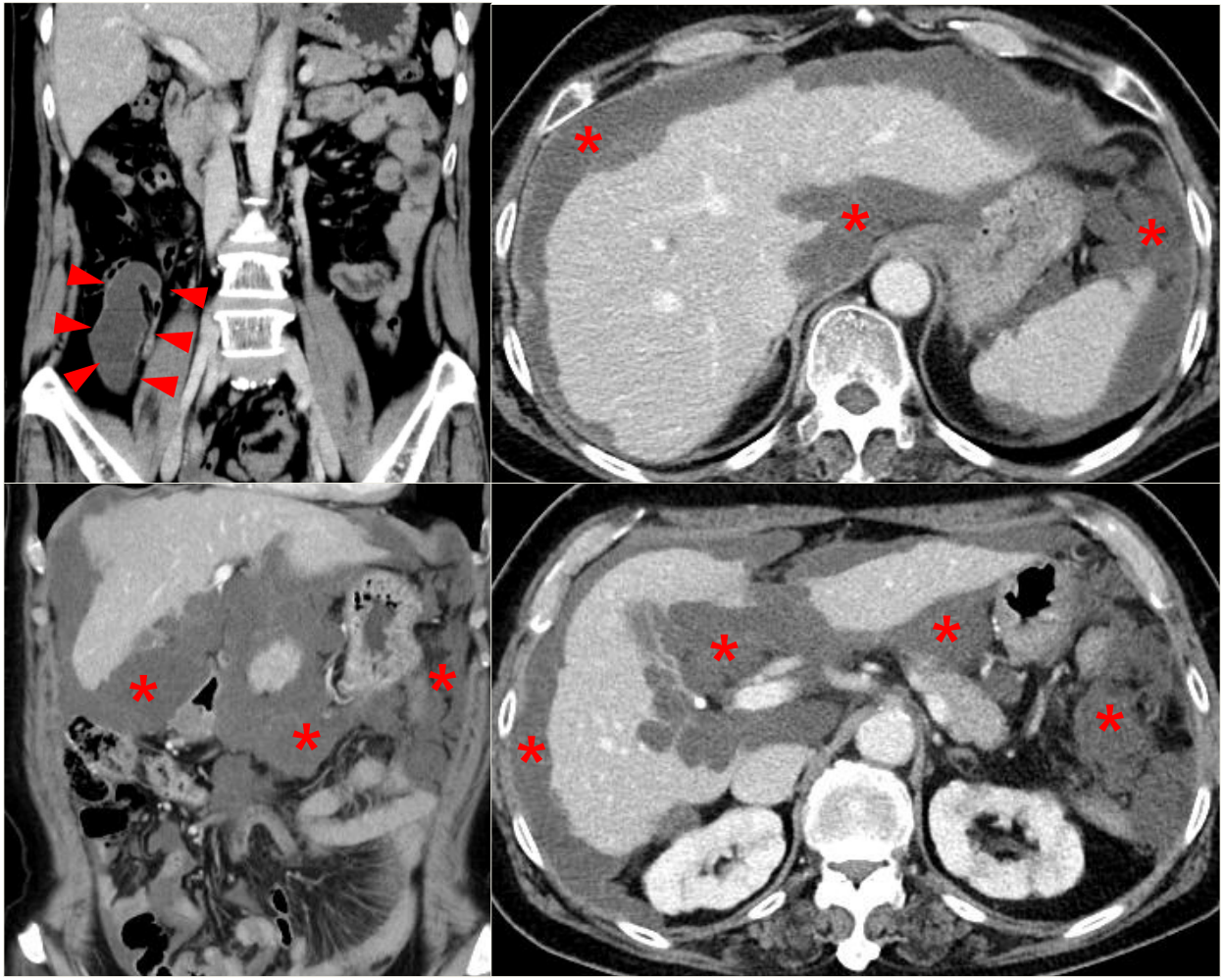
What is the most likely diagnosis ?



A 54-year-old female

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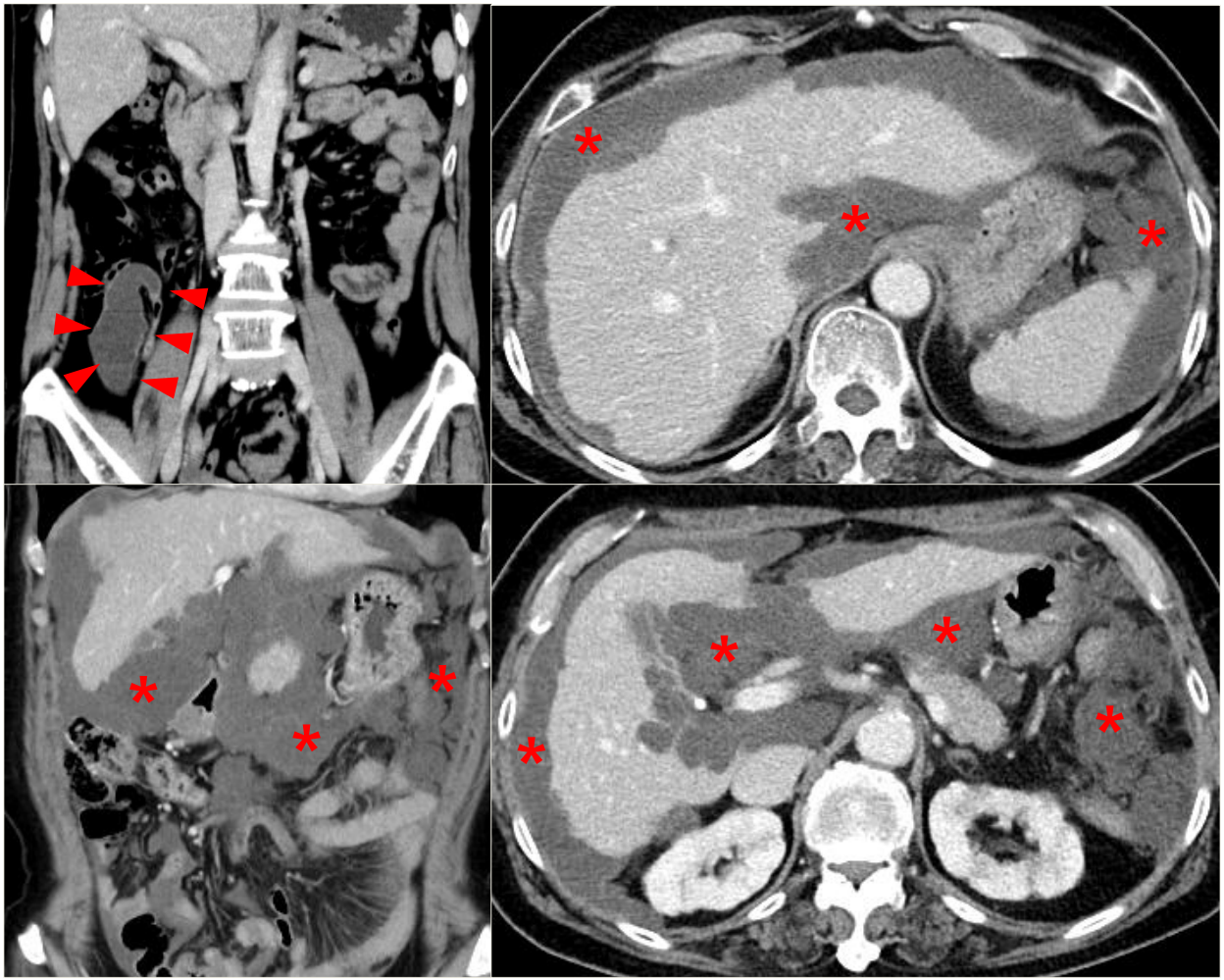
Pseudomyxoma Peritonei

(from appendiceal mucinous cystadenoma)



A 54-year-old female

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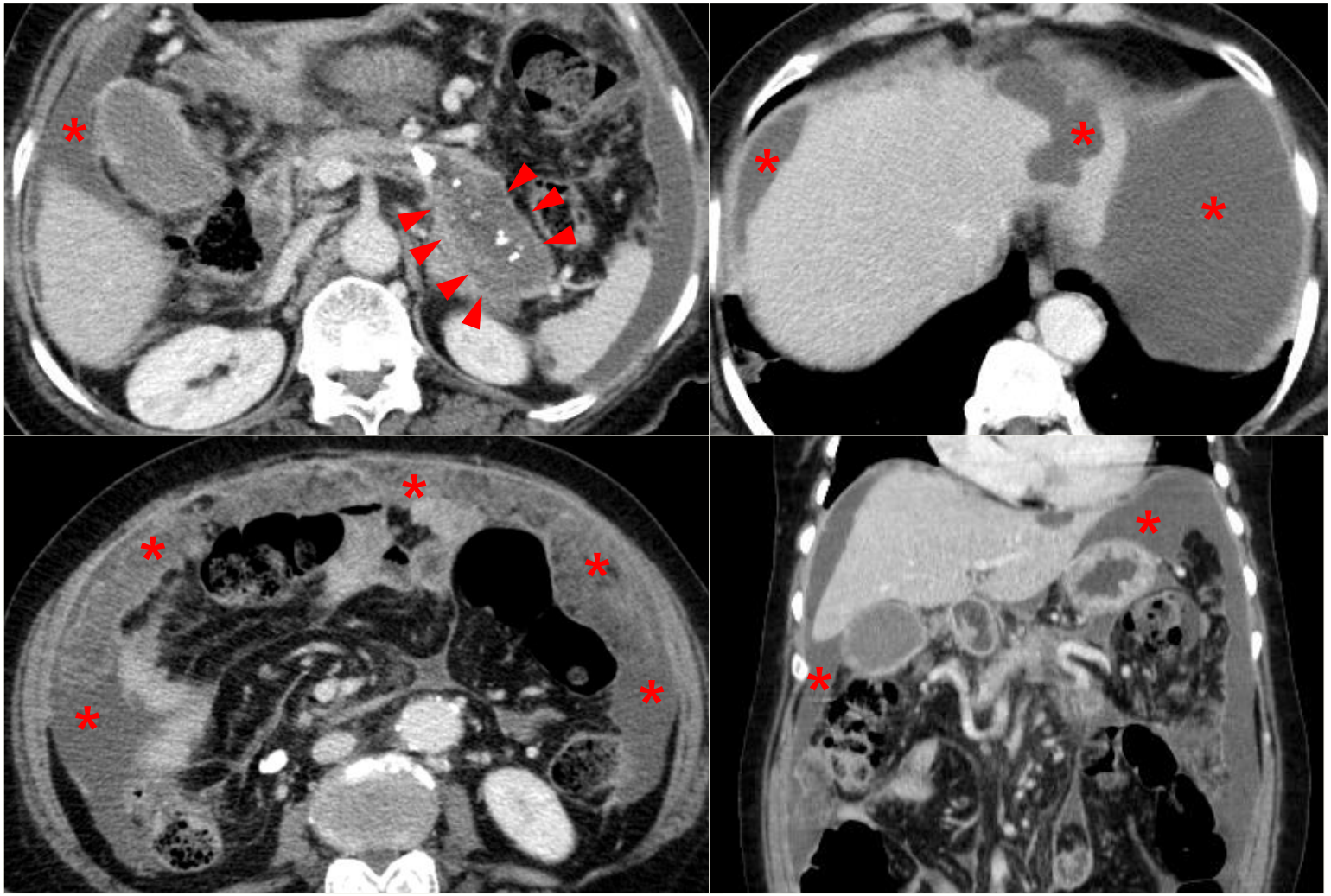
What is the most likely diagnosis ?



A 68-year-old female

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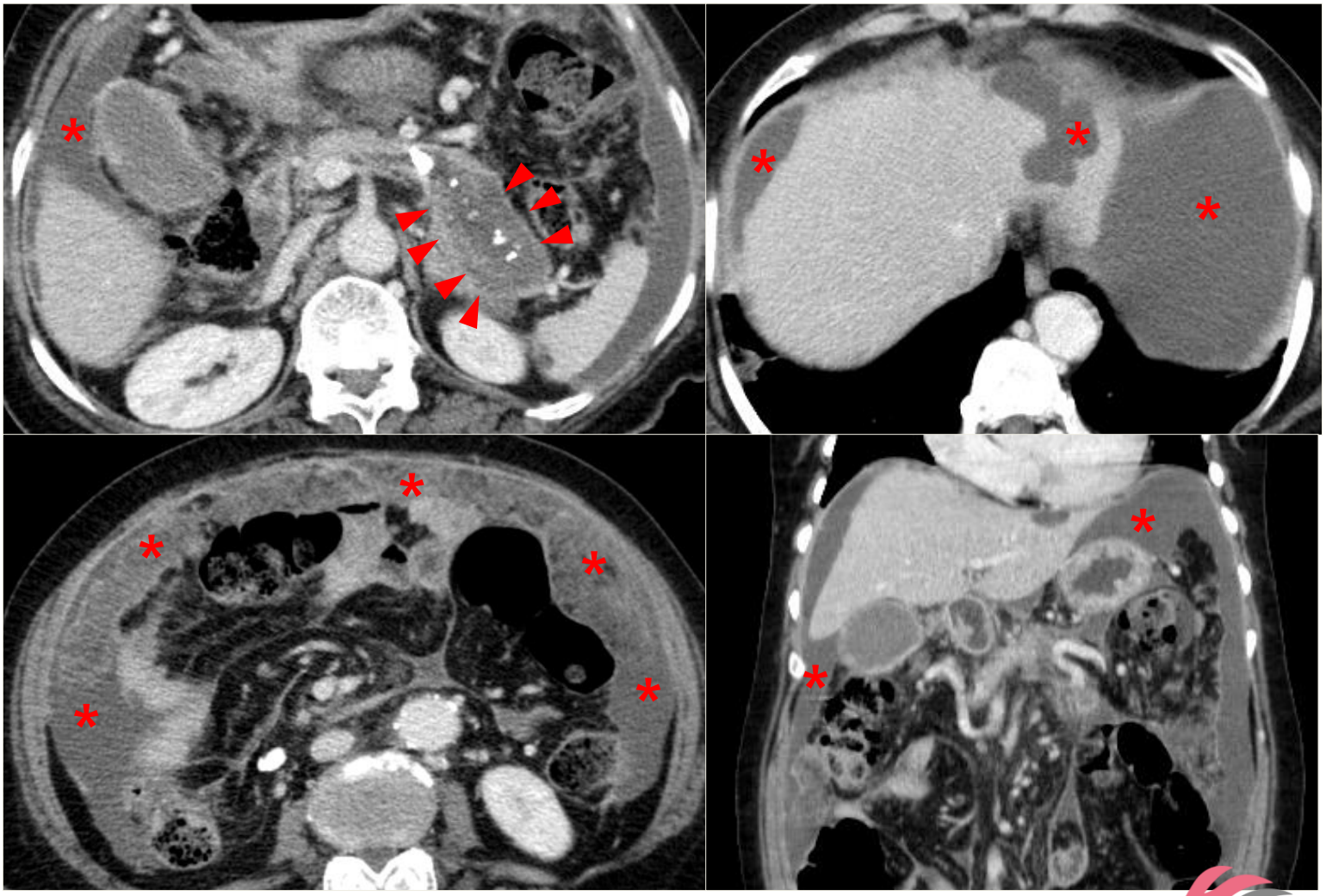
Pseudomyxoma Peritonei

(from pancreatic cancer)



A 68-year-old female

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Pseudomyxoma Peritonei

- Pseudomyxoma peritonei describes thick mucinous or gelatinous materials covering peritoneal cavity.
- It divided into two categories
  - Disseminated Peritoneal AdenoMucinosis (DPAM)
    - consists of benign epithelial cells or well-differentiated low-grade mucinous carcinomas
    - not invade the stroma
    - usually presents indolent clinical course
    - majority of pseudomyxoma peritonei and commonly arises in the appendix.
  - Peritoneal Mucinous CarcinomAtosis (PMCA)
    - invasive
    - consists of high-grade, moderately or poorly differentiated mucinous carcinoma
    - stromal invasion
    - rare, arise in mucinous carcinoma of the gastrointestinal tract, ovary, and pancreas
- Imaging findings
  - low attenuated (<20HU) loculated fluid collection with scalloping of visceral surface and presence of septa
  - some may present high attenuation
  - calcification is rare

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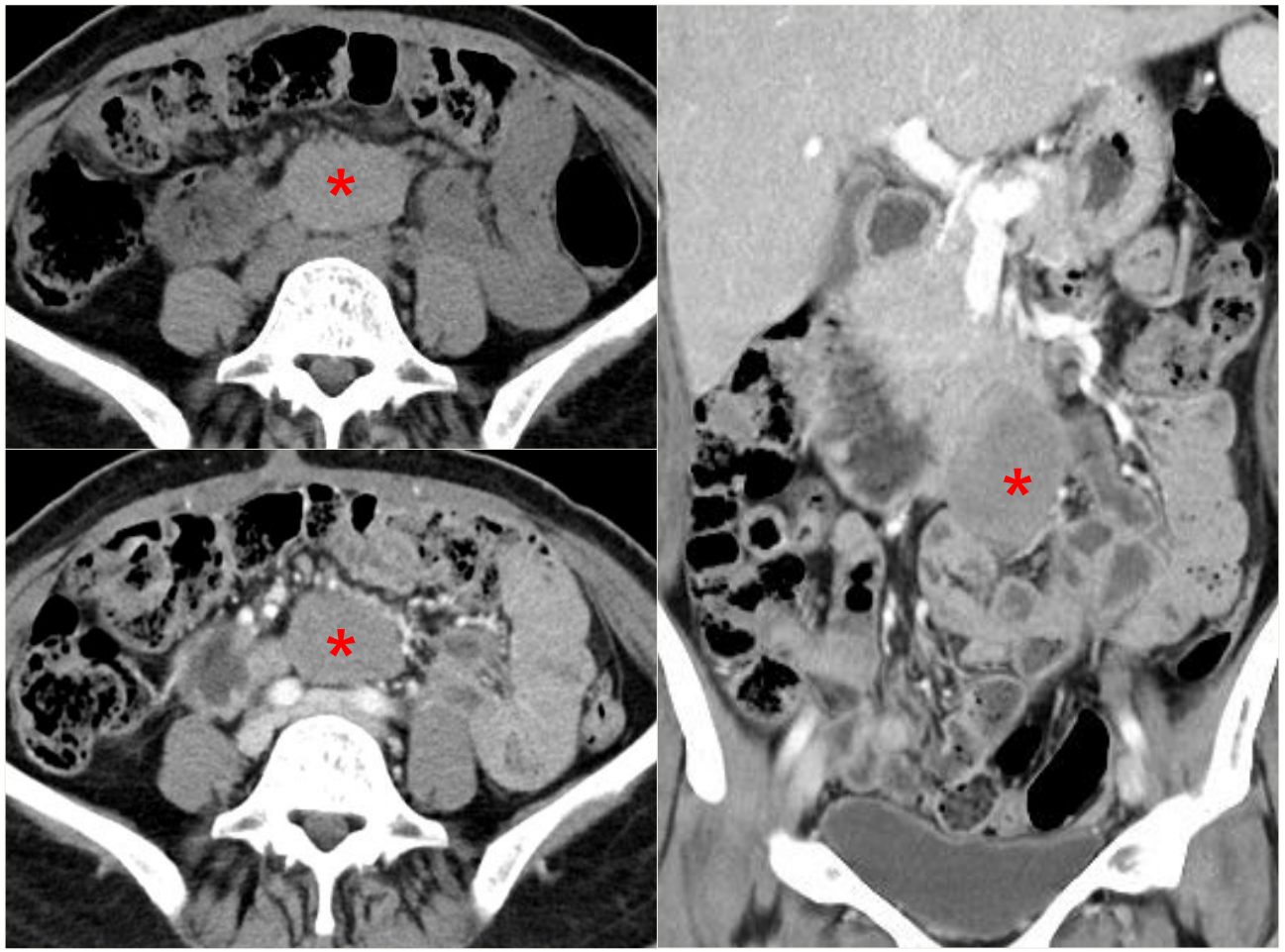
What is the most likely diagnosis ?



A 50-year-old female, history of previous hysterectomy

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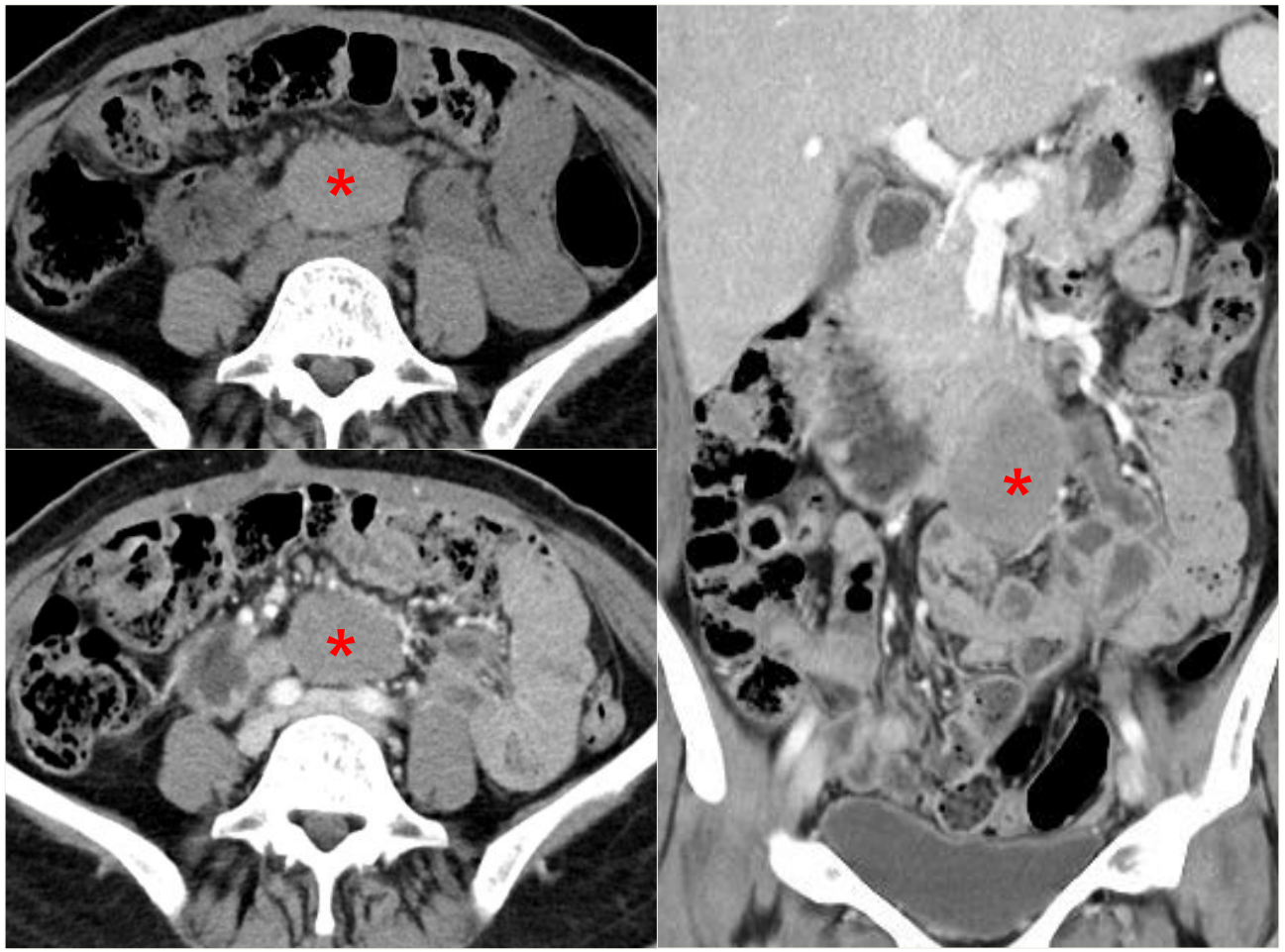
Desmoid Tumor



A 50-year-old female, history of previous hysterectomy

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Desmoid tumor

- rare, benign, but locally aggressive tumor
- benign proliferation of fibrous tissue
- anywhere in the abdomen
- frequent in young multiparous women
- commonly related with previous abdominal surgery
- approximately 20% of cases are associated with Gardner syndrome.
- Imaging findings
  - either solitary or multiple
  - commonly a well-defined solid mass, but sometimes ill-defined margins due to fibrosis growing in to the mesenteric fat
  - relatively homogeneously isoattenuating to the muscle and can be focally low attenuated caused by necrosis
  - large size (>10cm), multiplicity, extensive infiltration, or obstruction of bowel loops or ureter are considered as poor prognostic factors.

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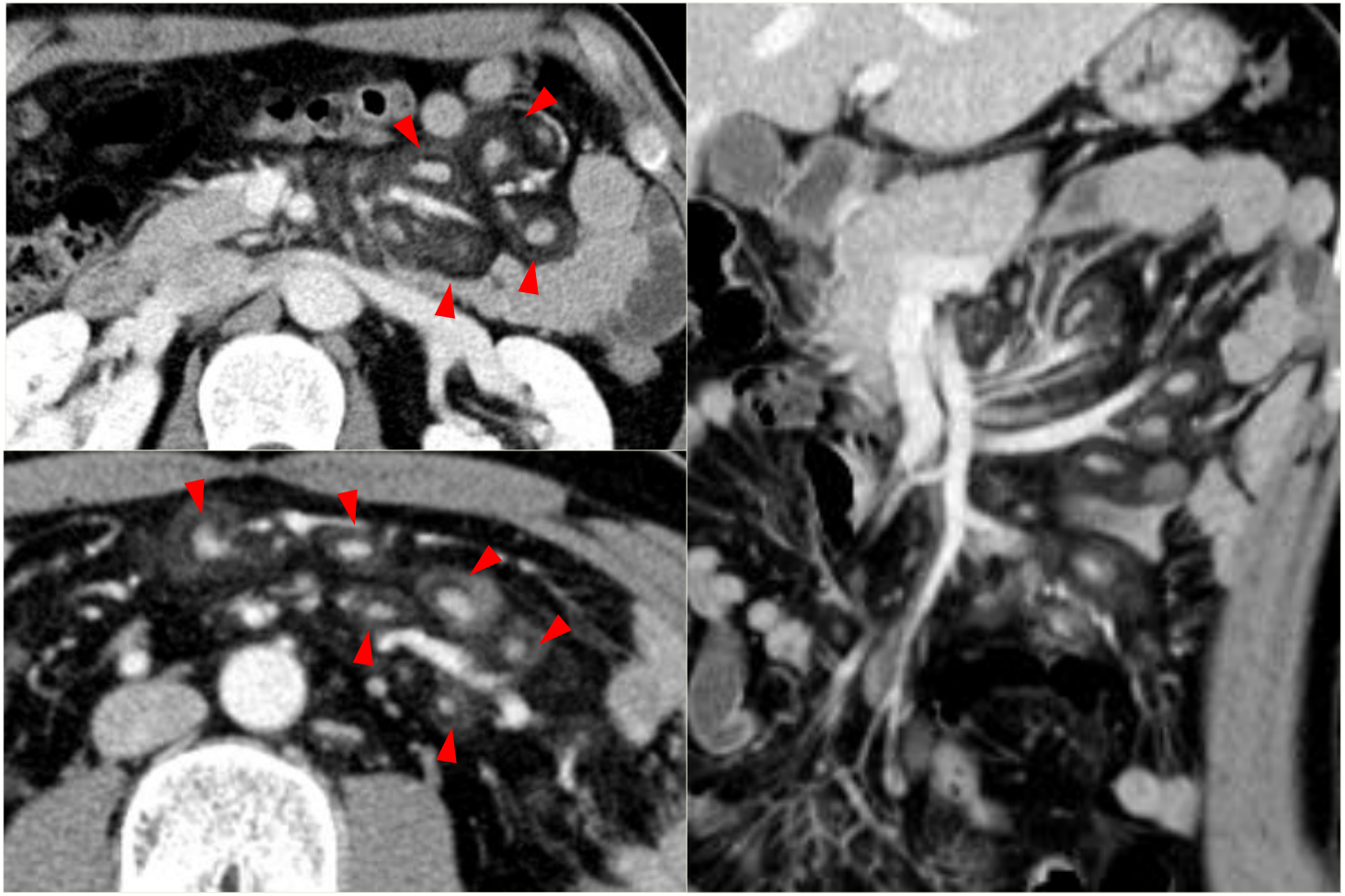
What is the most likely diagnosis ?



A 38-year-old male

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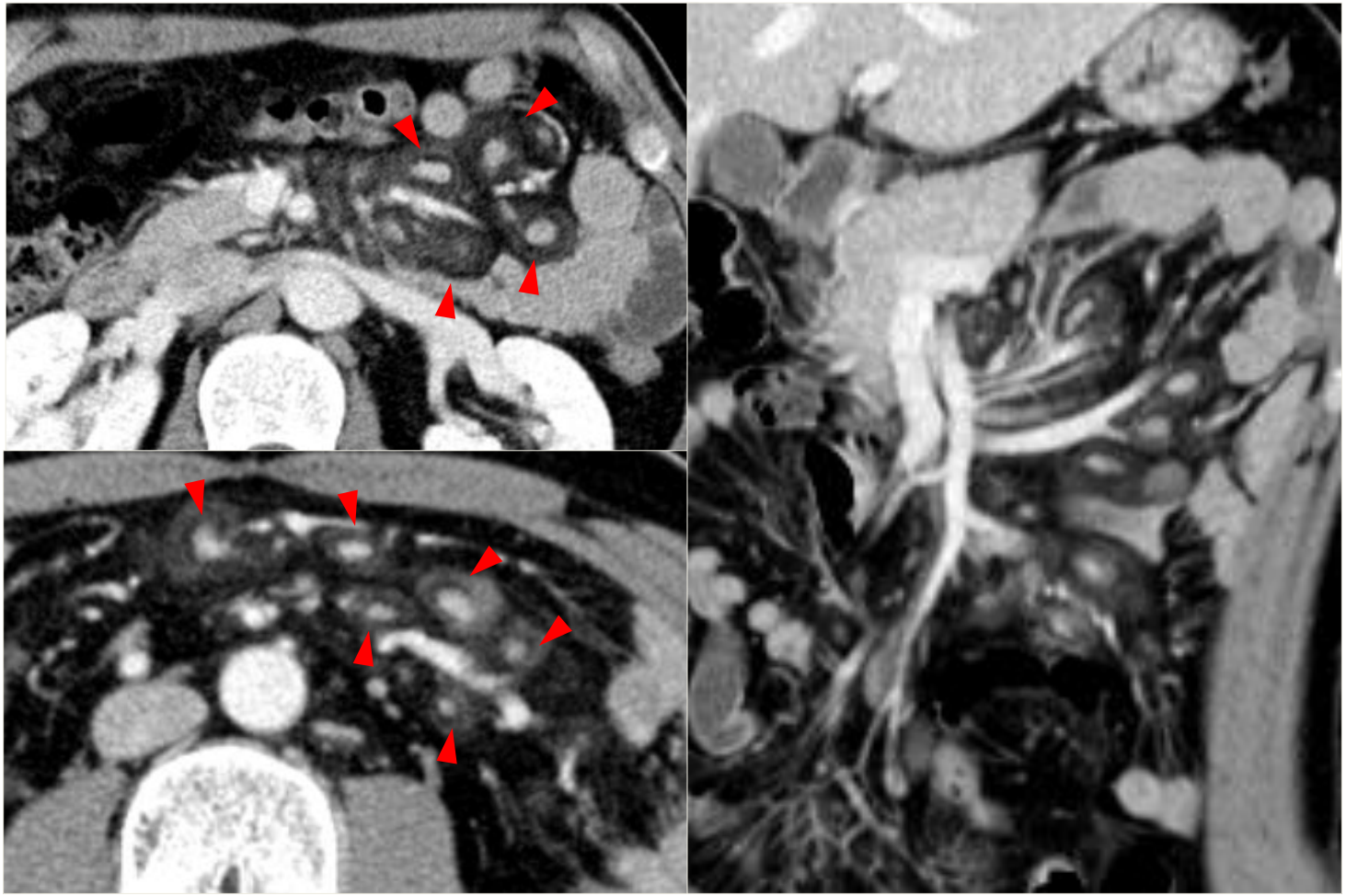
Mesenteric Panniculitis



A 38-year-old male

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Sclerosing Mesenteritis (mesenteric panniculitis)

- Complex inflammatory disorder of the mesenteric fat
- Three subgroups depending on the amount of inflammation, fat necrosis, and fibrosis:
  1) Mesenteric panniculitis refers to a condition when the inflammation is predominant. On CT, it appears as a focal area of increased attenuation within the mesenteric fat. Preservation of perivascular fat present as fat ring sign
  2) Mesenteric lipodystrophy is associated with fat necrosis, showing calcification.
  3) Chronic form or retractile mesenteritis, fibrosis is predominant.
- Imaging findings
  - irregular fibrotic mesenteric masses often with calcification
  - difficult to carcinoid tumor and desmoid tumor

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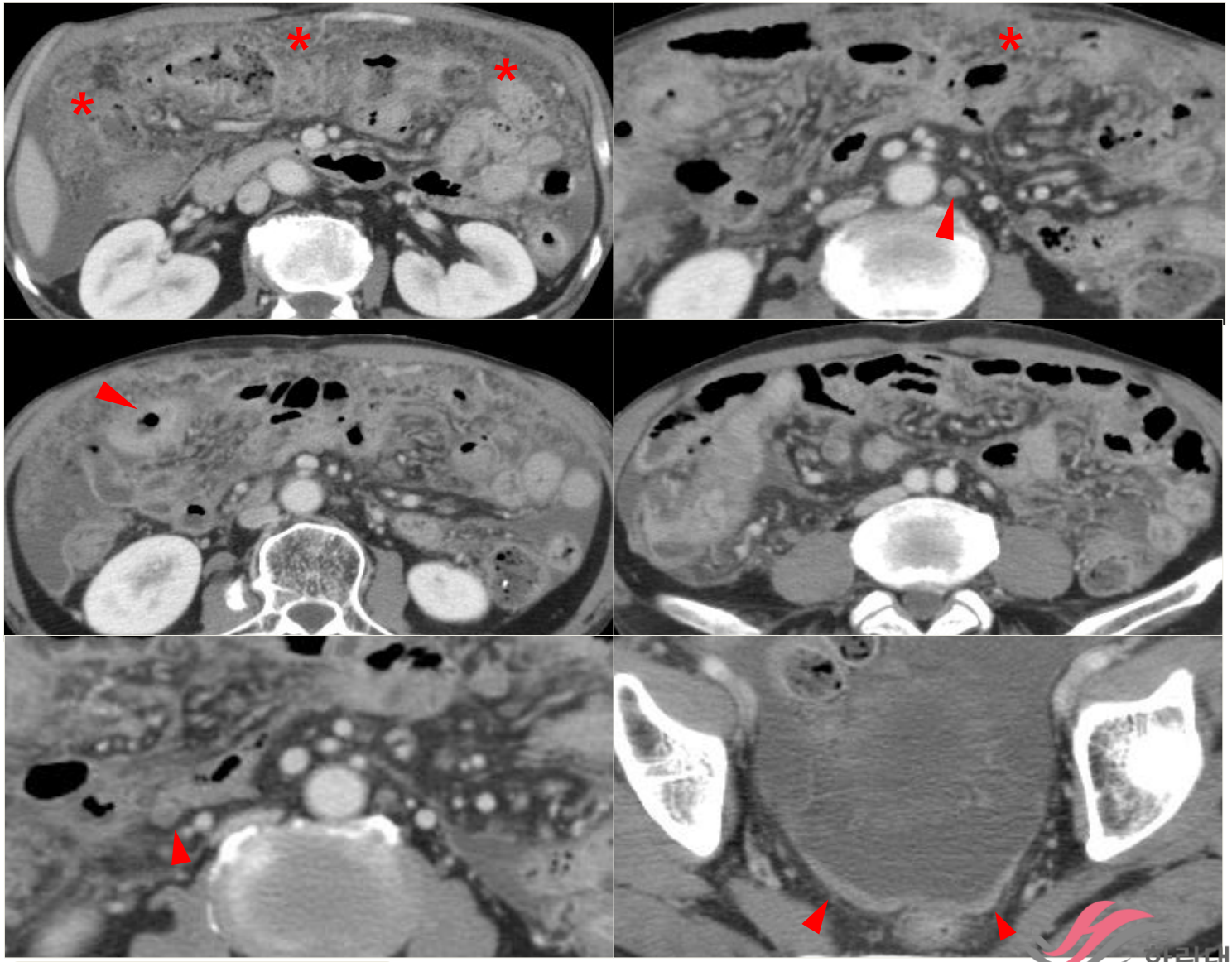
What is the most likely diagnosis ?



A 57-year-old male

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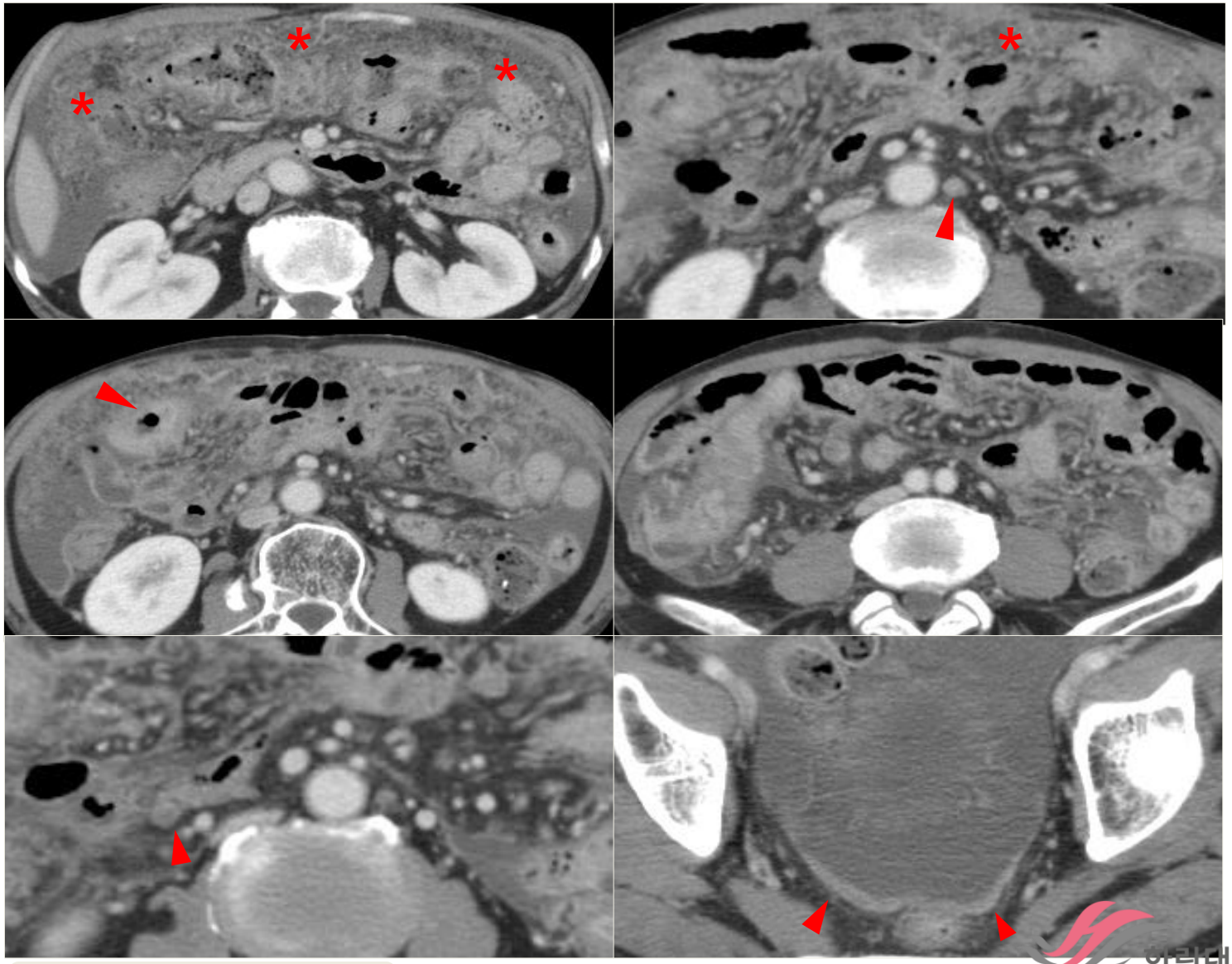
Tuberculosis Peritonitis



A 57-year-old male

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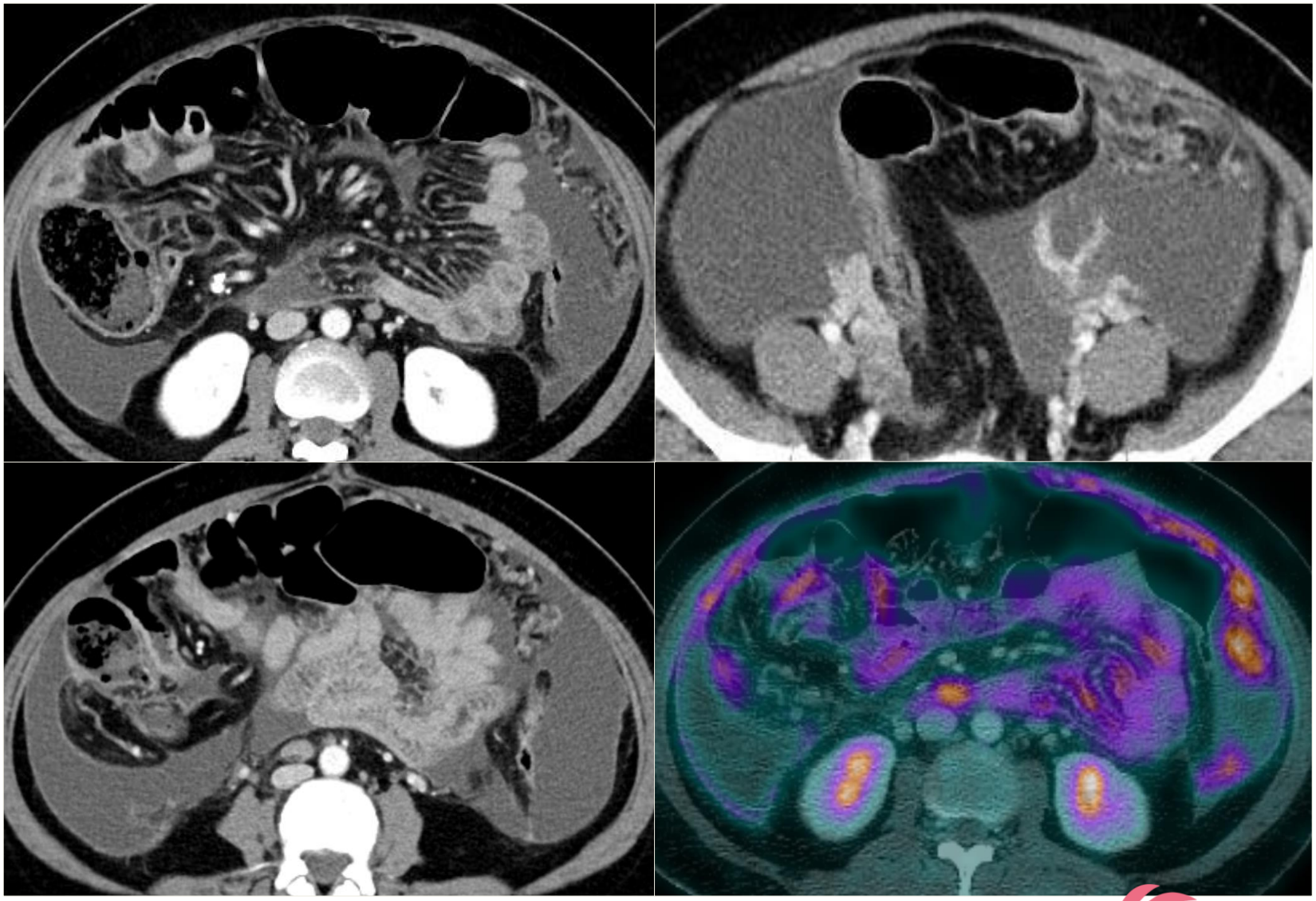
Tuberculosis Peritonitis



A 42-year-old female

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Tuberculosis Peritonitis

- Abdominal tuberculosis can be seen in upto 38% of patients with primary pulmonary tuberculosis, or it may also directly extend from gastrointestinal tract or nodal disease.
- There are three types (usually all three types overlap in a patient)
  1) Wet type: most common and characterized by large amount of ascites
  2) Fibrotic type: large omental and mesenteric masses are observed
  3) Dry type: diffuse fibrotic peritoneal thickening
- Imaging findings
  - similar to peritoneal carcinomatosis, showing omental and mesenteric mass, diffuse peritoneal thickening, and ascites.
  - enlarged mesenteric, portal hepatis, or retroperitoneal lymph nodes with or without calcification
  - thickening of terminal ileum, and microabscess or calcifications of liver or spleen.
  - tuberculosis ascites can show slightly higher attenuation than simple ascites.

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What is the most likely diagnosis ?

A 44-year-old female

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Actinomycosis

A 44-year-old female

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Actinomycosis

A 39-year-old female

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Actinomycosis

- slowly progressive infection caused by anaerobic gram-positive bacteria, which is normal flora colonizing the mouth, colon, and vagina
- Related to the disruption of the intestinal mucosal integrity or prolonged use of intrauterine device.
- Imaging findings
  - mimic malignant disease, because of aggressive infiltrative soft tissue masses with marked enhancement.
  - violating normal anatomic boundaries and extensive propagation across tissue planes
  - localized, rather than spreading
  - regional lymphadenopathy and ascites are uncommon

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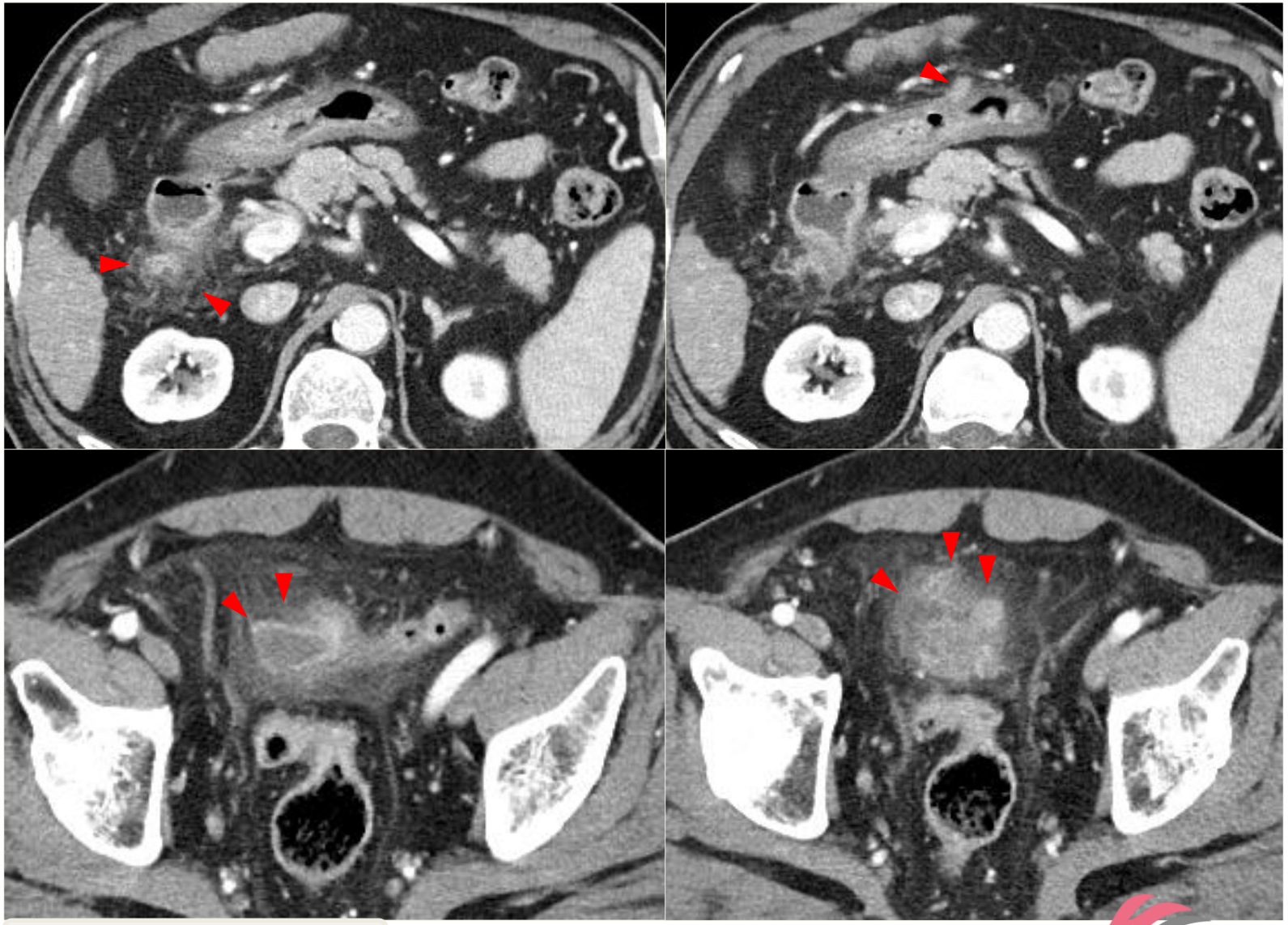
What is the most likely diagnosis ?



A 74-year-old male

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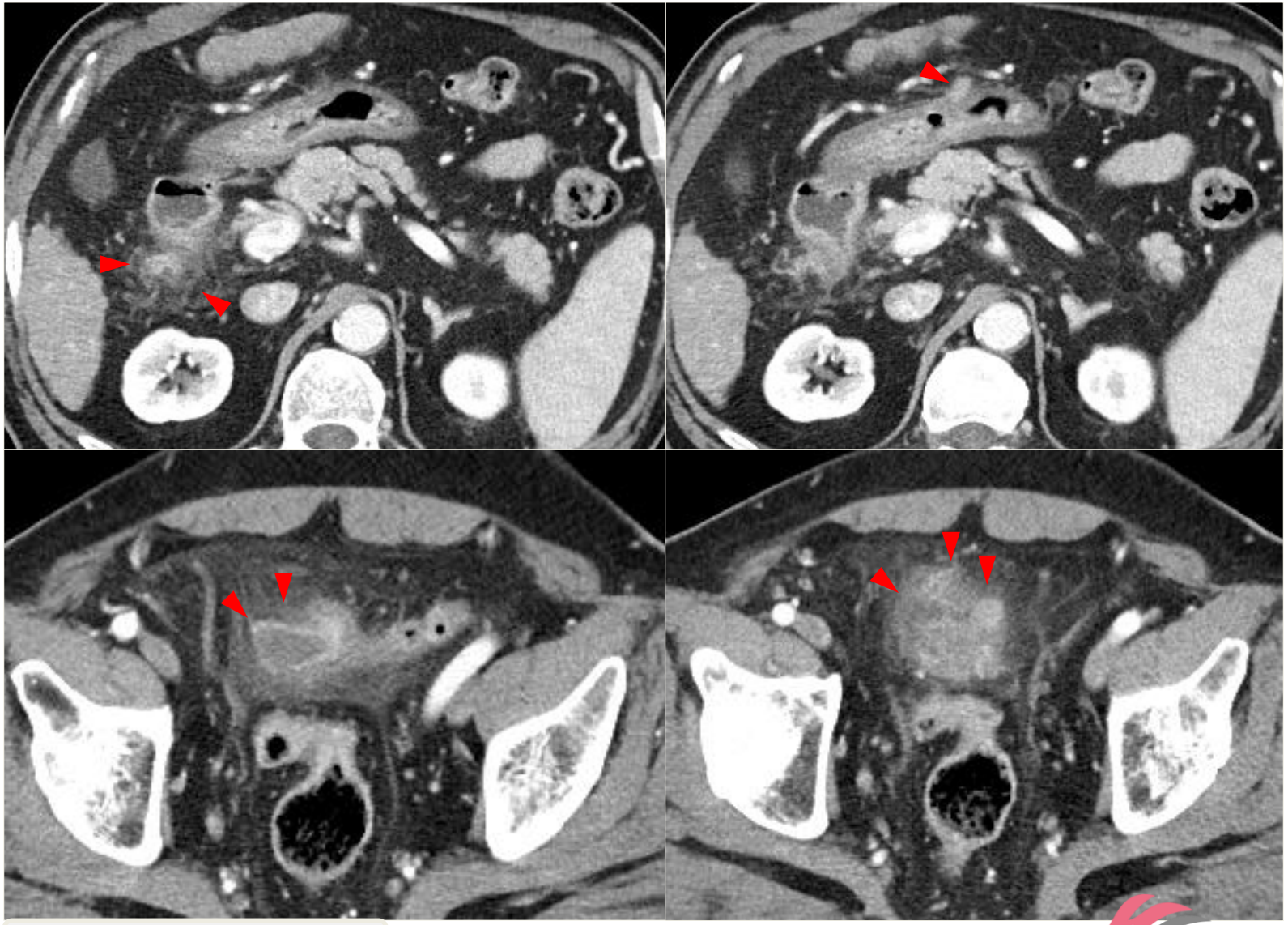
Parasite Infection-Toxocara



A 74-year-old male

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Parasite Infection

- Some parasites penetrate the intestinal mucosa, causing an extensive inflammatory reaction, and peritoneal parasitosis may occur in any type of parasites that penetrate the bowel
- In patients with suspected parasite infection and vague abdominal symptoms, CT is useful to evaluate the presence and extent of intraperitoneal involvement of parasitic infestation.
- Imaging findings
  - Nonspecific, similar to carcinomatosis peritonei
  - Pathognomic feature of the fistula tract formed by the parasite through the intestinal tract
  - varying degree of omental or mesenteric infiltration
  - single or multiple peritoneal mass or nodule
  - peritoneal thickening or stranding, and mild lymphadenopathy, and small amount of ascites
  - in chronic stage, the omentum and mesentery may present extensive adhesions, fibrosis, and nodules as the sequelae.

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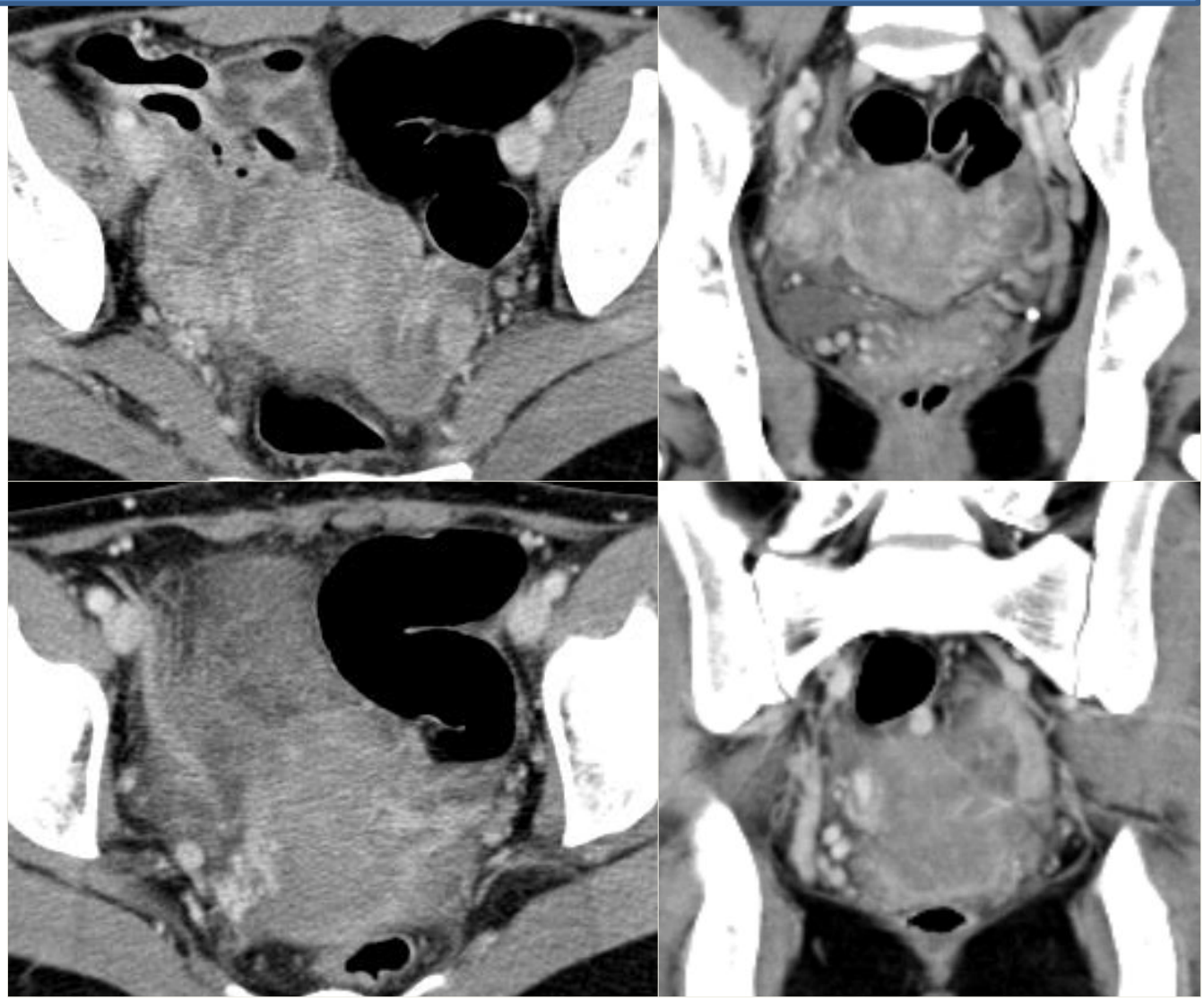
What is the most likely diagnosis ?



A 34-year-old female

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PID

- Pelvic inflammatory disease is a broad term explaining infection of the female upper genital tract and surrounding tissues

- Imaging findings
  - pelvic edema and salpingitis
  - presenting as pelvic fat haziness
  - peritubal stranding, and thickening of fallopian tubes or uterosacral ligament
  - tubo-ovarian abscess
  - perihepatitis known as Fitz-Hugh-Curtis syndrome

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Conclusion

A wide spectrum of diseases can involve the mesentery and peritoneum. Although nonspecific imaging findings make it difficult to establish the differential diagnosis among various diseases, this self-assessment education exhibition would be helpful to analyze the characteristic and unique imaging features of peritoneal and mesenteric-origin diseases.

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