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Ovarian Cancer- Radiographic Diagnosis and Staging

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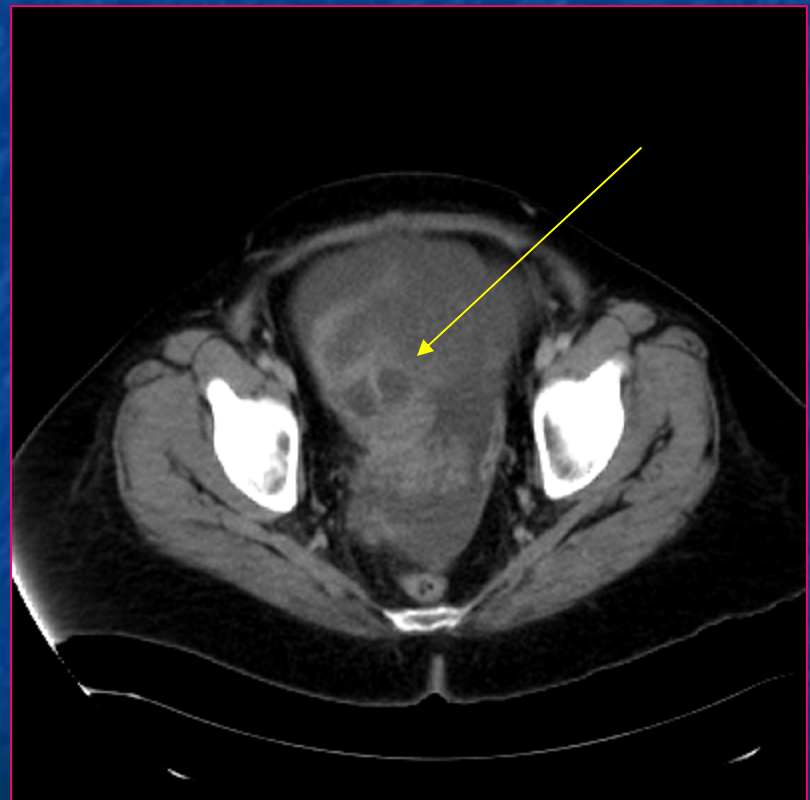
Patient #1: Ms. S

- 51 y.o. female, G0P0
- Presented to E.D. with abdominal distension
- Liver enzymes normal
- 4.5 L ascitic fluid removed from abdomen, testing positive for malignant cells!
- CT scan of abdomen performed



Ms. S, continued

- CT revealed 10x13 cm mass in R adnexa
- Tumor surgically removed
- determined to be stage II clear cell carcinoma



Courtesy:
Chad Brecher, MD. BIDMC



Ovarian Cancer- background

- Epidemiology:
 - Approx. 1/100 women die of ovarian cancer
 - *Leading cause of death from gynecological malignancy in U.S.*
 - *More deaths than from cervical and endometrial cancers combined!*
 - Of 25,400 new cases diagnosed each year in U.S.- 70% already in advanced stages (III/IV)
 - Average age at diagnosis: 63
- Symptoms:
 - abdominal distension and pain, dyspepsia, anorexia, weight loss, backache, bladder Sx
- Risk factors:
 - Nulliparity
 - family hx (attributed in ~5-10% of cases)
 - suppression of ovulation appears to be protective (pregnancy, oral contraceptive usage)
 - *Conversely, induction of ovulation with clomiphene has been suggested to increase risk of ovarian cancer*



Primary Ovarian Tumors- evaluation

- Tumor classification:
 - 90% epithelial (serous, mucinous, endometrioid)
 - 5% malignant metastasis, most commonly from breast, colon, gastric, lymphoma
 - *Signet cell metastasis from G.I. = Krukenberg tumor*
- Screening:
 - Currently not recommended, as the positive predictive value of tests available not sufficiently high
- Radiologic methods of primary tumor evaluation:
 - Ultrasound
 - CT
 - (MRI)



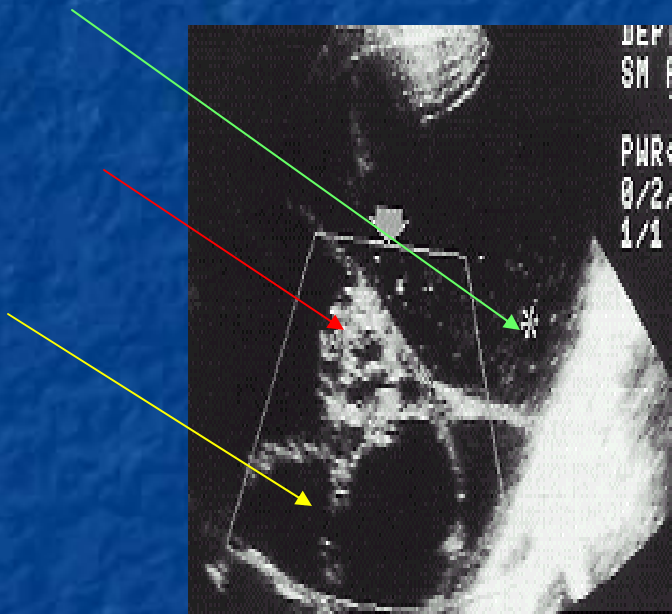
Imaging modalities for evaluation of ovarian neoplasm- Ultrasound

- Benefits:
 - Inexpensive and readily available
- Limitations:
 - Lack of tissue specificity, inability to detect tumors <1 cm
- Findings suggestive of malignancy:
 - Multiloculated mass >5cm
 - Thick septation
 - Ascites
 - Omental "cake" (mesenteric metastasis)
 - Paraaortic lymph node enlargement
 - Hepatic metastasis
- Doppler ultrasound- Can evaluate tumor blood flow.
 - Malignant tumors tend to have blood flow with high velocity and low impedance- tumor blood vessels lack muscular media
 - RI- Resistive Index: measure of impedance <0.4 suggestive of malignancy



Primary ovarian tumor- evaluation with ultrasound- Example #1

- Factors favoring a diagnosis of a malignant tumor:
 - Multilocularity
 - Mural nodularity
 - Echogenecity

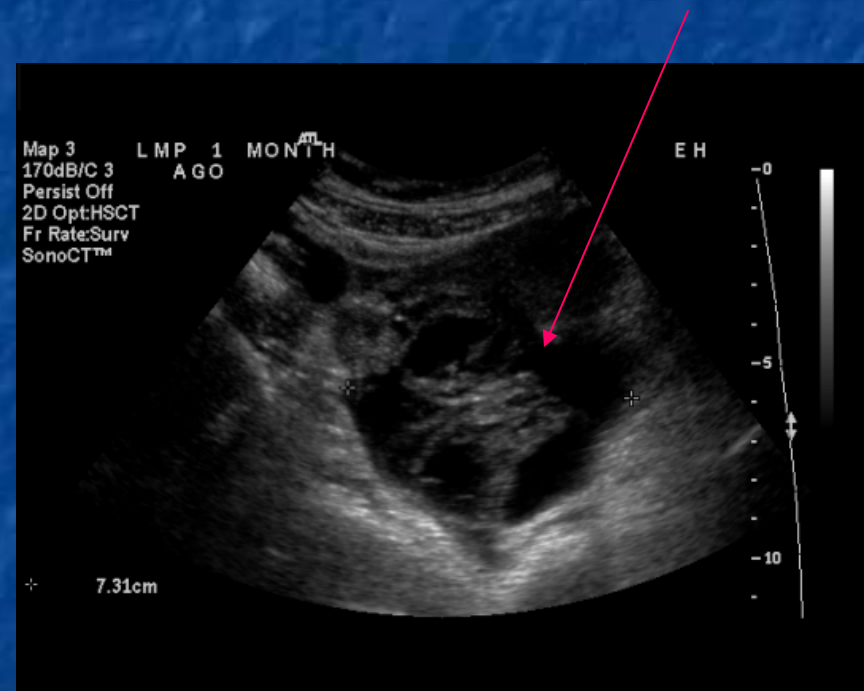


Spencer and Kurtz, *Clinical Radiology*, 48(2), 1993



Primary ovarian tumor- Evaluation w/ultrasound, example #2

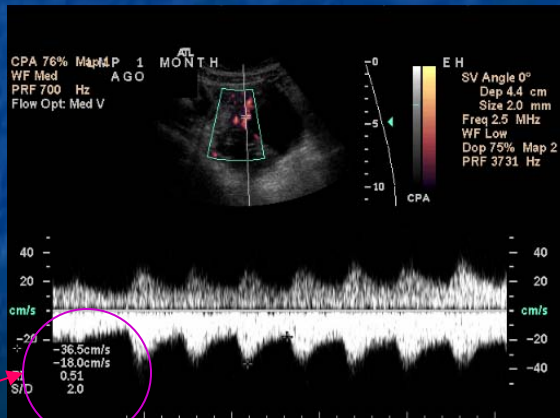
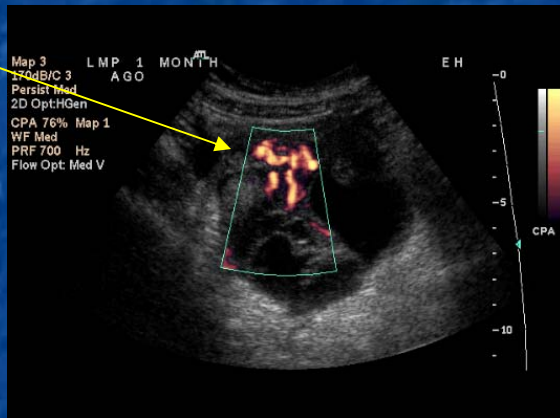
- Factors favoring a diagnosis of malignancy:
 - multiloculated mass



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Primary ovarian tumors- evaluation w/ultrasound, example #3



- Factors favoring a diagnosis of malignancy:
 - Doppler ultrasound demonstrated increased flow to tumor
- Factors not supporting a diagnosis of malignancy:
 - Resistive index (RI)=0.5 (<0.4 predictive of cancer)

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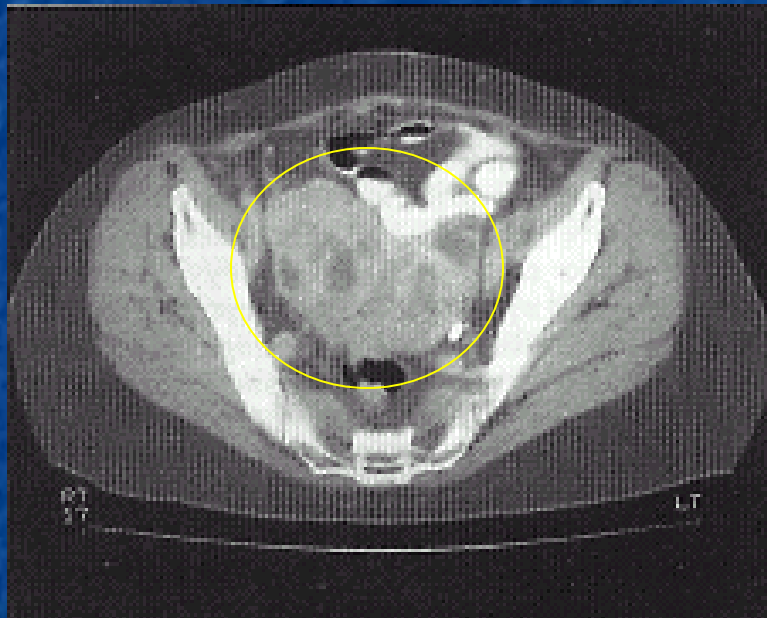


Imaging modalities for evaluation of ovarian neoplasm- CT

- As seen with Patient 1, Ms. S, a primary ovarian tumor is often discovered on CT ordered for nonspecific abdominal symptoms
- CT imaging method of choice for past 15y for pre-operative evaluation of ovarian cancer
- Involved in ovarian mass characterization, determination of preoperative disease extent, prediction of tumor resectability
- Benefits:
 - Better at detecting tumors 1-2cm
- Limitations:
 - Inability to detect bowel surface, mesenteric surface implants <5cm
- Findings suggestive of malignancy:
 - Multiloculated mass >5cm
 - Mural nodularity
 - Wall and septal thickness and irregularity
 - Paraaortic lymph node enlargement
 - Hepatic metastasis



Primary ovarian tumor- Evaluation w/CT, example #1

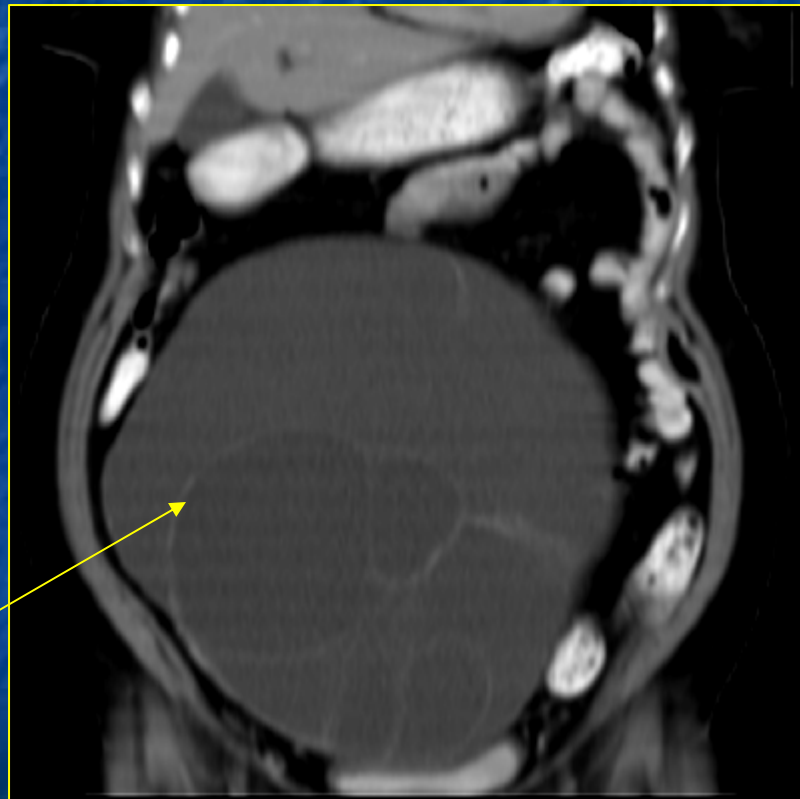


Johnson,R.J. *Clinical Radiology*, 48(2), 1993

- Attenuation of tumor can aid in determining subtype
 - Serous cystadenoma-attenuation similar to H₂O
 - Mucinous cystadenoma-attenuation similar to soft tissue
- Factors which favor a diagnosis of malignancy:
 - Wall and septal thickness and irregularity
 - Enhancing nodules



Primary ovarian tumor- Evaluation w/CT, example #2



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- 24.2 x 23.7 x 16.5 cm septated cystic mass
- Factors favoring a diagnosis of malignancy:
 - Multiloculated mass >5cm
- mucinous cystadenoma-attenuation intermediate between soft tissue and water



Other imaging modalities less commonly used to evaluate ovarian neoplasm

- Plain film radiography:
 - Distension of gas-filled loops of bowel by tumor may be seen
 - ~12% patients w/ serous cystadenoma develop psammomatous calcification of primary tumor, metastases
 - Chest radiography detects pulmonary metastases
- Intravenous urography
 - Used to detect pelvic mass which distorts normal architecture of bladder or obstructs ureters
- Barium enema
 - Used to detect displacement of bowel, fixation or tethering of bowel due to mets
- MRI
 - Better soft tissue contrast
 - Indicated in patients w/ IV contrast allergy, renal insufficiency, pregnancy
- Lymphangiography
 - Ovaries drain to paraaortic nodes, occasionally to middle chain of external iliac nodes
- Angiography
 - Occasionally used to delineate hepatic masses



Staging

- Staging usually performed at time of surgical resection, but stage of disease may be estimated though imaging studies
- Staging important to determine treatment, prognosis
- CT is imaging method of choice
- Accuracy of radiologic staging ~87-95%

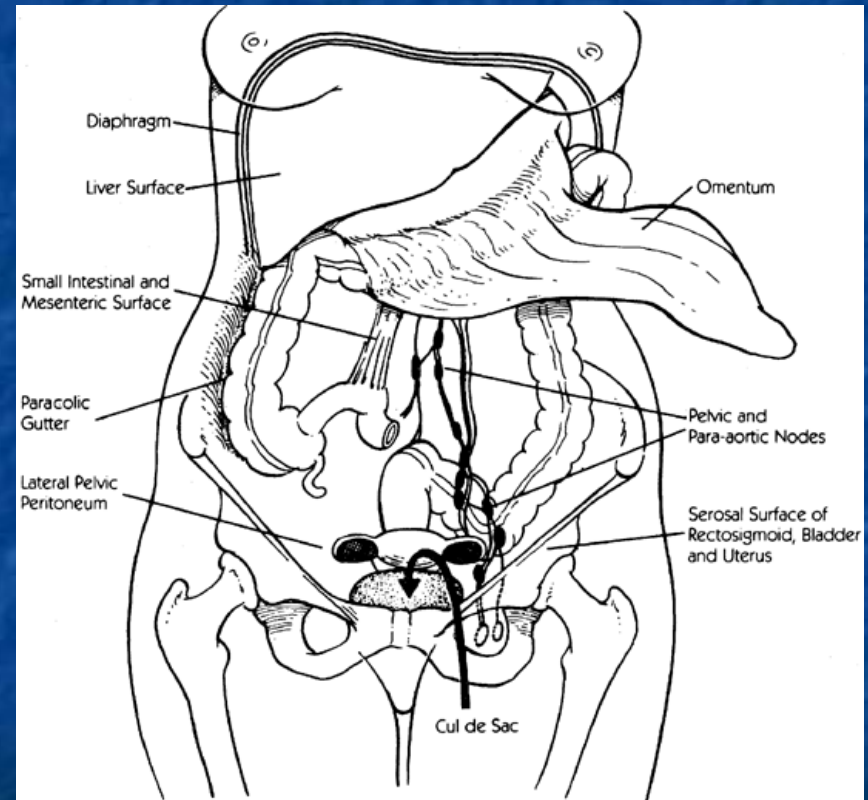
FIGO (International Federation of Obstetrics and Gynecology)- Staging of Ovarian Cancer, (abridged)

Stage	Description	5 yr survival
I	Growth limited to ovaries	85%
II	Growth limited to pelvis	55%
III	Growth limited to abdomen	14%
IV	I+ Distant mets, parenchymal liver mets	4%



Metastasis

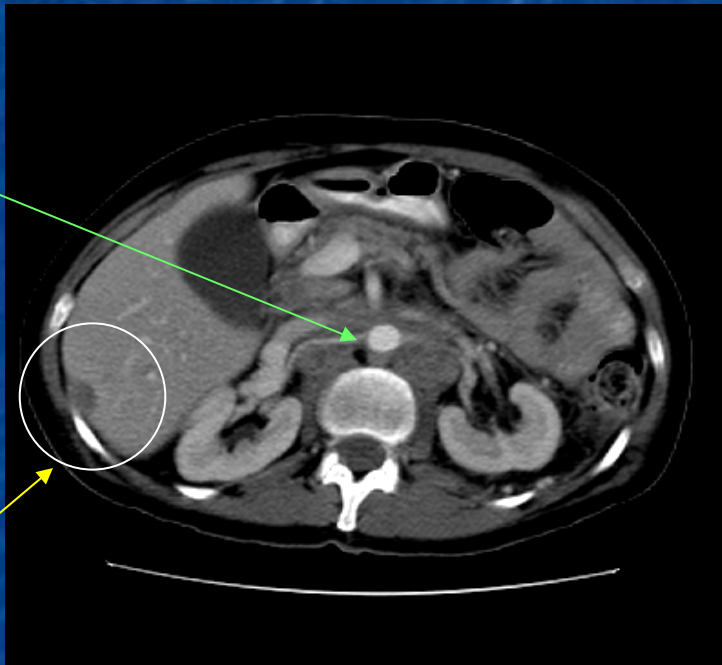
- Ovarian cancer spreads contiguously to adjacent organs, through:
 - peritoneal seeding
 - lymphatics
 - bloodstream
- Common sites of metastasis:
 - pouch of Douglas, sigmoid colon
 - right lower quadrant, right paracolic gutter, Morrison's pouch
 - *Cells follow circulatory path of peritoneal fluid, moving with the force of respiration from the pelvic up the right paracolic gutter*
 - *Note: spread of tumor via left paracolic gutter impeded by phrenocolic ligament*
- Progressively agglutinates loops of bowel, leading to functional intestinal obstruction, or carcinomatous ileus
- *Pleural effusion+ascites+ovarian tumor= pseudo-Meigs syndrome*



- Devita, V.; Hellman, S.; Rosenberg S.;
- *Cancer: Principles and Practice of Oncology*



Metastasis- Example #1

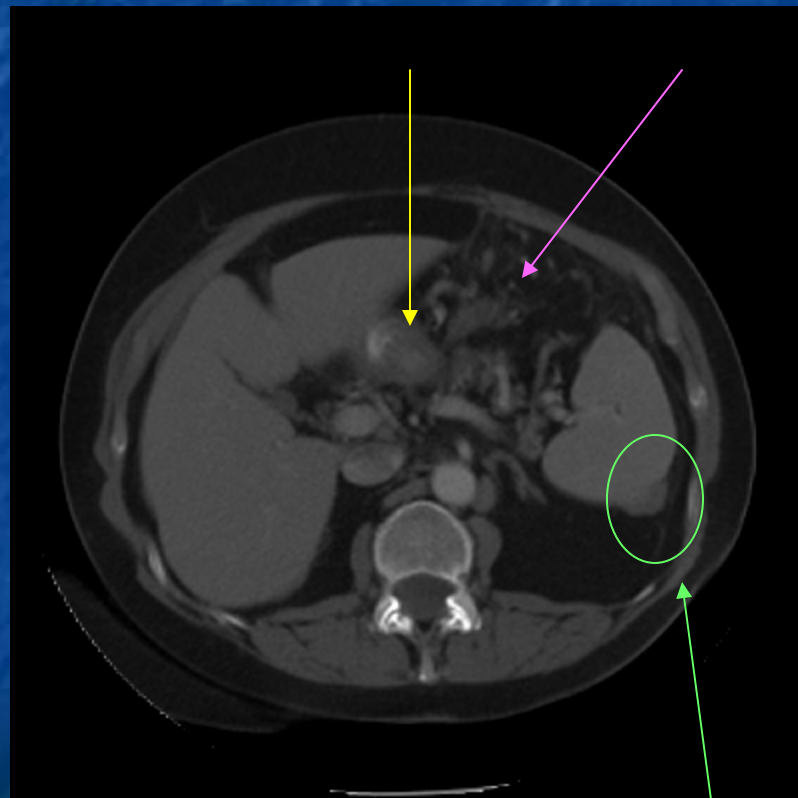


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- Low attenuation metastatic nodule on liver capsule
- Diffuse paraaortic lymph node enlargement
- Presence of hepatic metastasis indicates stage ≥ 3



Metastasis- Example #2

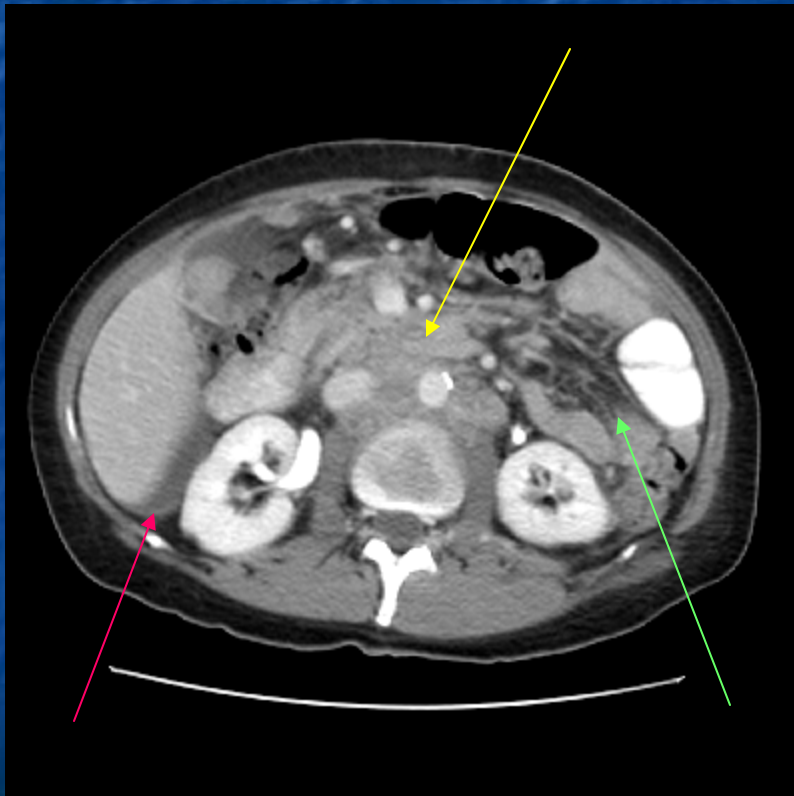


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- Metastasis to spleen
- Stranding in omentum and mesentery
- Soft tissue masses in omentum
- Presence of abdominal metastasis indicates stage ≥ 3



Metastasis- Example #3



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- Fluid located in Morrison's pouch (hepatorenal space)
- Enlarged lymph nodes
- Diffuse omental metastasis
- Presence of abdominal metastasis indicates stage ≥ 3



The Role of Radiology in Ovarian Cancer Management/ Follow-up

- CT useful following tumor debulking surgery to insure the absence of residual tumor
- CA-125 levels found to correspond to cancer recurrence
- Therefore, CT and CA-125 are the methods of choice for monitoring patients with diagnosed ovarian cancer for recurrence

CA-125

- Elevated in 50% patients with stage I ovarian CA, in 80% patients w/stage III/IV ovarian CA
- Also elevated in:
 - First trimester pregnancy
 - Endometriosis
 - Cirrhosis
 - 40% patients w/abdominal, non-ovarian malignancy
 - 1% healthy controls



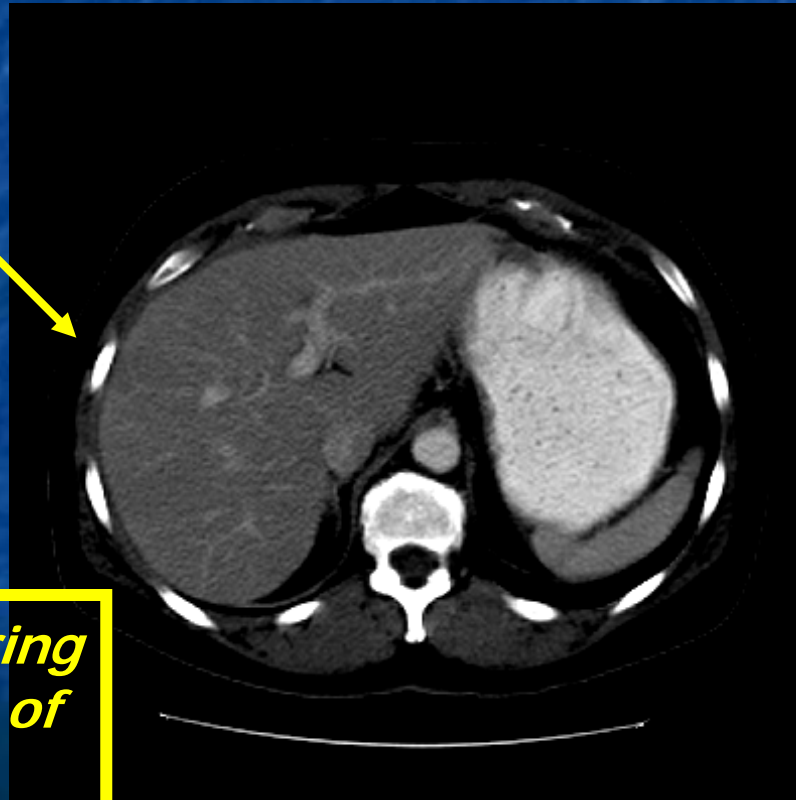
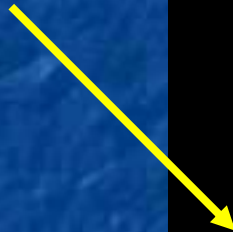
Patient #2: Ms. R

- 61 y.o. nulliparous female
- Diagnosed with stage IV ovarian cancer
- Underwent tumor debulking surgery
- Returned to BIDMC for follow-up monitoring for recurrence



Patient #2: Ms. R, following tumor debulking surgery

Liver Margins
clear



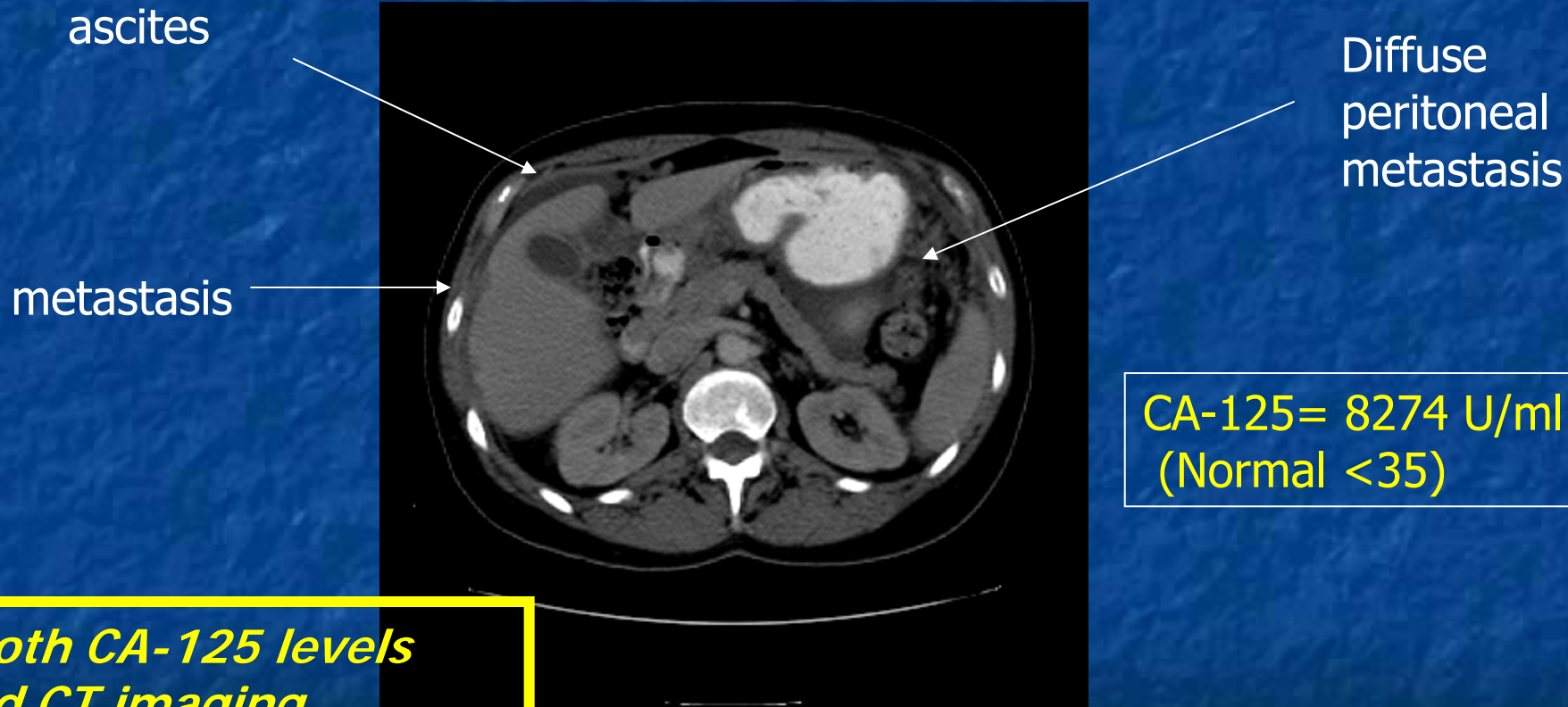
CA-125= 17U/ml
(Normal <35)

CT useful for ensuring adequate debulking of primary tumor and metastases

Courtesy:
Michael Goldfinger, MD. BIDMC



Patient #2: Ms. R, 2 years later



****Both CA-125 levels and CT imaging demonstrate recurrence of the disease***

Courtesy:
Michael Goldfinger, MD. BIDMC



Summary

- Although asymptomatic screening for ovarian cancer is not yet recommended, radiographic studies are valuable for principal evaluation, staging, and follow-up
- Ultrasound and CT are most commonly used for characterization of primary tumor
- CT and CA-125 levels are relied upon for monitoring recurrence



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