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 adenexa
- 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)
  - Supression 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” (mesentariic 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
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)
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

- 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

Johnson, R.J. *Clinical Radiology*, 48(2), 1993
Primary ovarian tumor- Evaluation w/CT, example #2

- 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)

<table>
<thead>
<tr>
<th>Stage</th>
<th>Description</th>
<th>5 yr survival</th>
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<tbody>
<tr>
<td>I</td>
<td>Growth limited to ovaries</td>
<td>85%</td>
</tr>
<tr>
<td>II</td>
<td>Growth limited to pelvis</td>
<td>55%</td>
</tr>
<tr>
<td>III</td>
<td>Growth limited to abdomen</td>
<td>14%</td>
</tr>
<tr>
<td>IV</td>
<td>I+ Distant mets, parenchymal liver mets</td>
<td>4%</td>
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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

- Low attenuation metastatic nodule on liver capsule
- Diffuse paraaortic lymph node enlargement
- Presence of hepatic metastasis indicates stage $\geq 3$
Metastasis- Example #2

- Metastasis to spleen
- Stranding in omentum and mesentary
- Soft tissue masses in omentum
- Presence of abdominal metastasis indicates stage $\geq 3$
Metastasis - Example #3

- Fluid located in Morrison’s pouch (hepatorenal space)
- Enlarged lymph nodes
- Diffuse omental metastasis
- Presence of abdominal metastasis indicates stage $\geq 3$
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

CT useful for ensuring adequate debulking of primary tumor and metastases*

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

*Courtesy: Michael Goldfinger, MD. BIDMC*
Patient #2: Ms. R, 2 years later

**CA-125** = 8274 U/ml
(Normal <35)

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

Courtesy:
Michael Goldfinger, MD. BIDMC

ascites

Diffuse peritoneal metastasis

metastasis
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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our Webmasters
References

References (cont.)