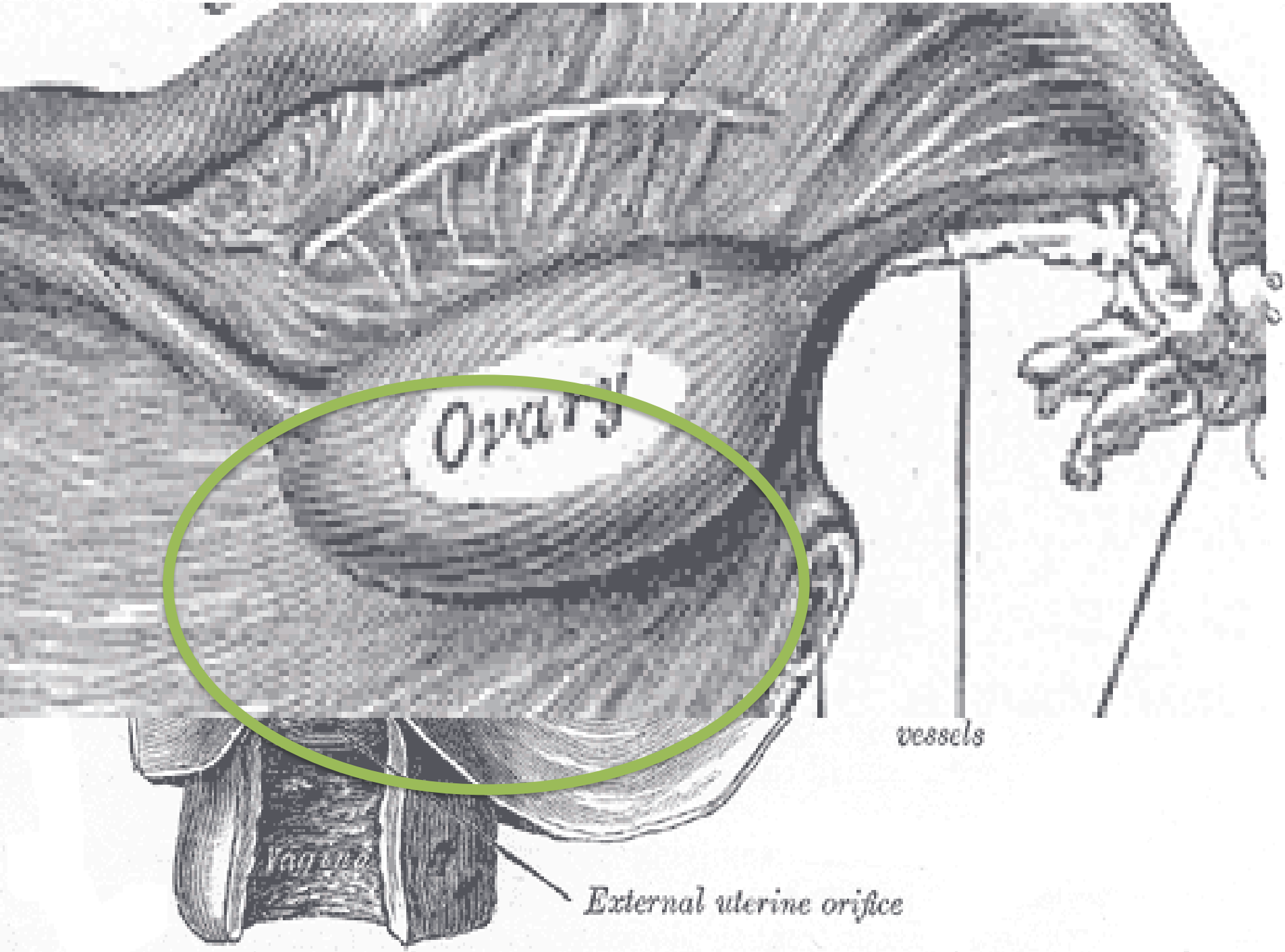
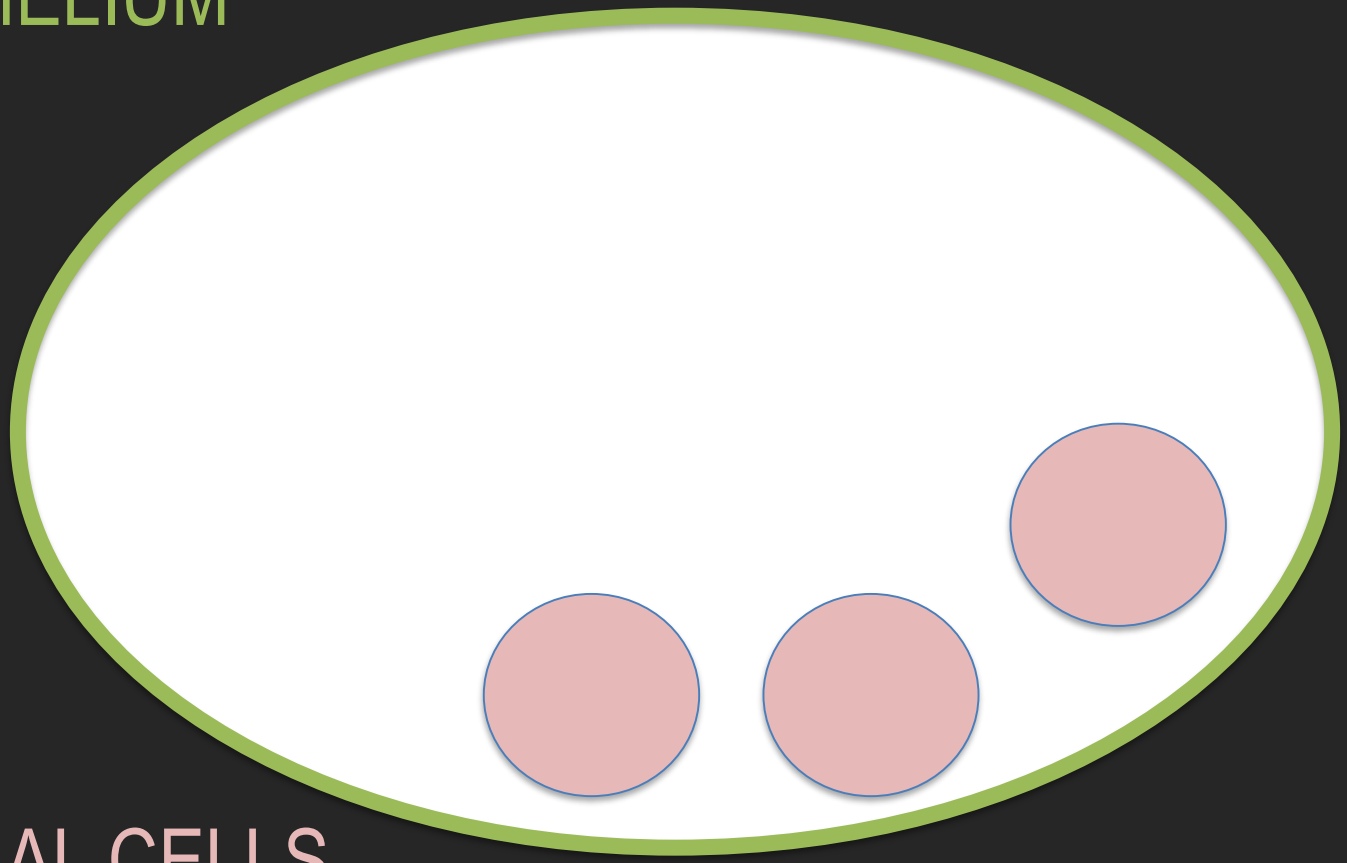
RAD-PATH ~~4-26-16~~ 6/20/16
Approach to Complex Cystic/Solid Ovarian Masses

Travis Caton & Matthew Torre


Ovary
vessels
Vagina
External uterine orifice

SURFACE EPITHELIUM

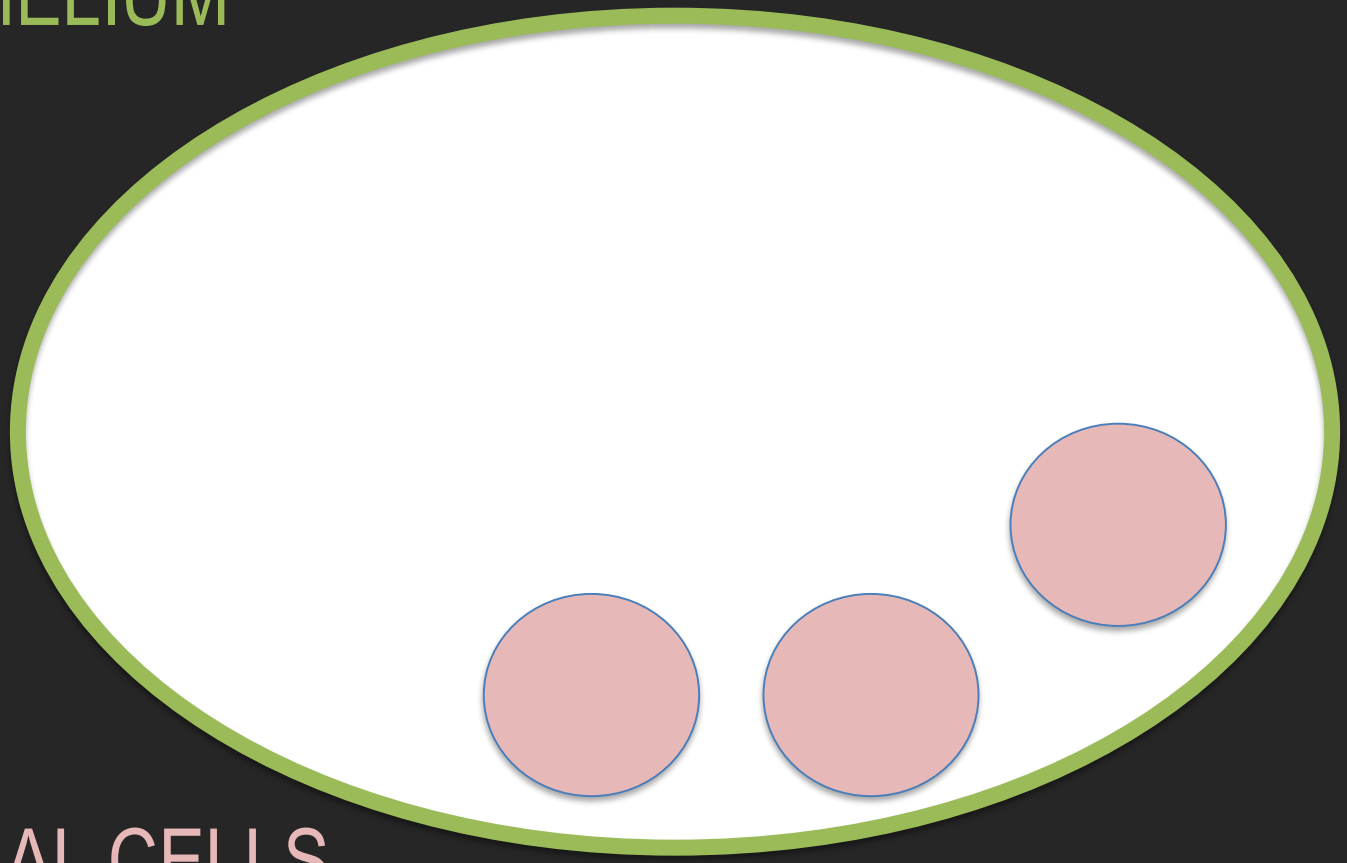
STROMAL CELLS



GERMINAL CELLS

SURFACE EPITHELIUM

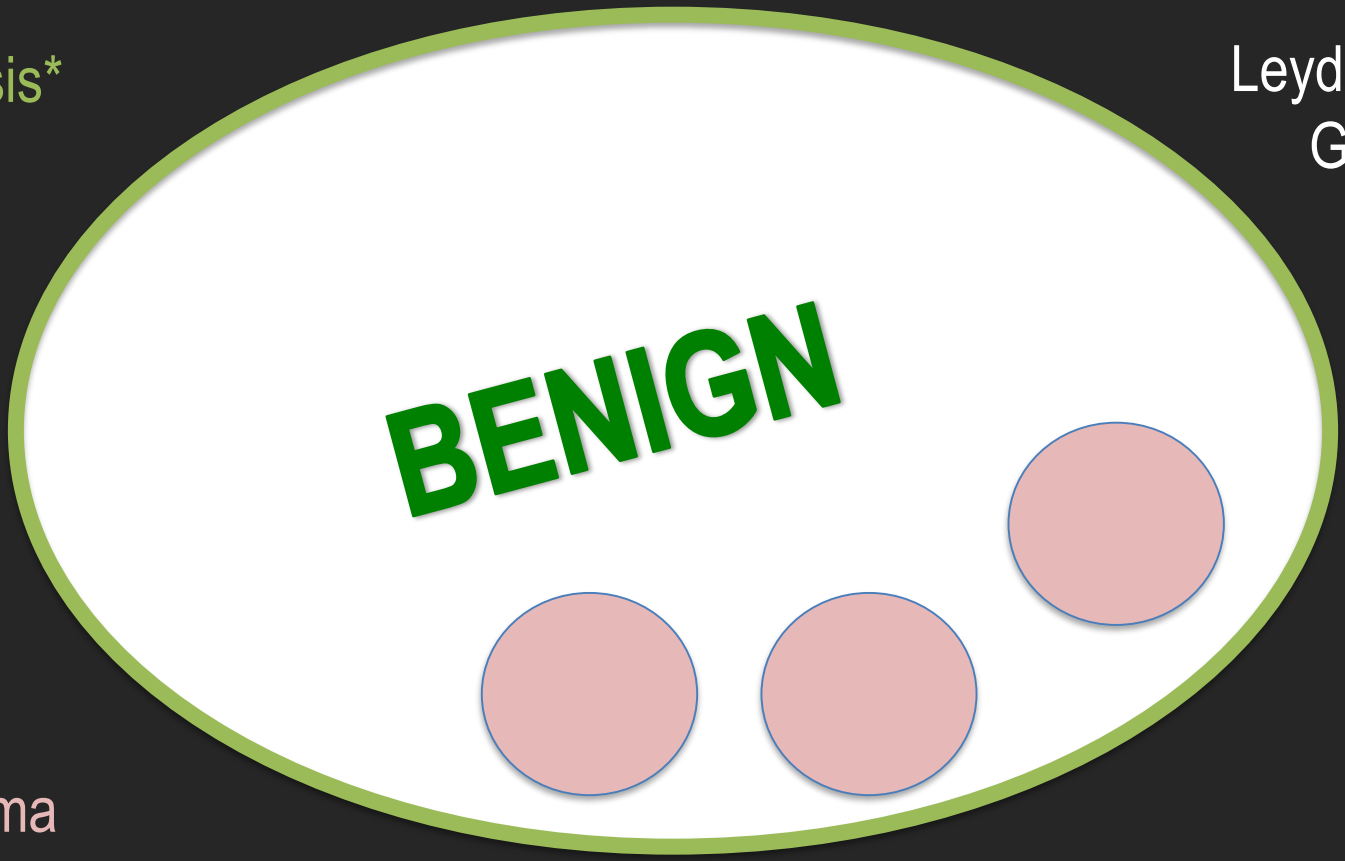
STROMAL CELLS



GERMINAL CELLS

Serous and Mucinous
Cystadenoma
Brenner Cell
Endometriosis*

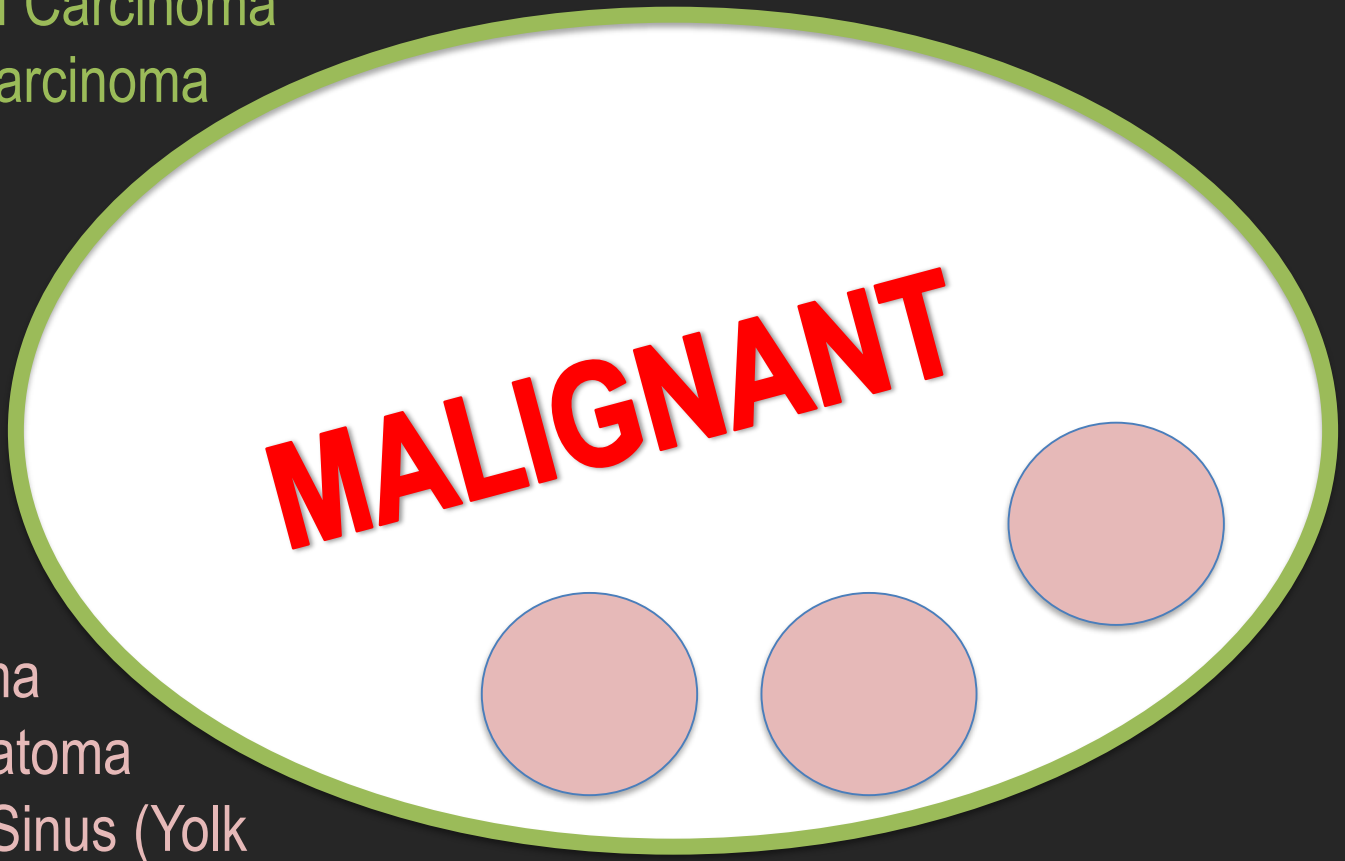
Fibroma
Thecoma
Sclerosing Stromal
Tumor
Leydig-Sertoli
Granulosa



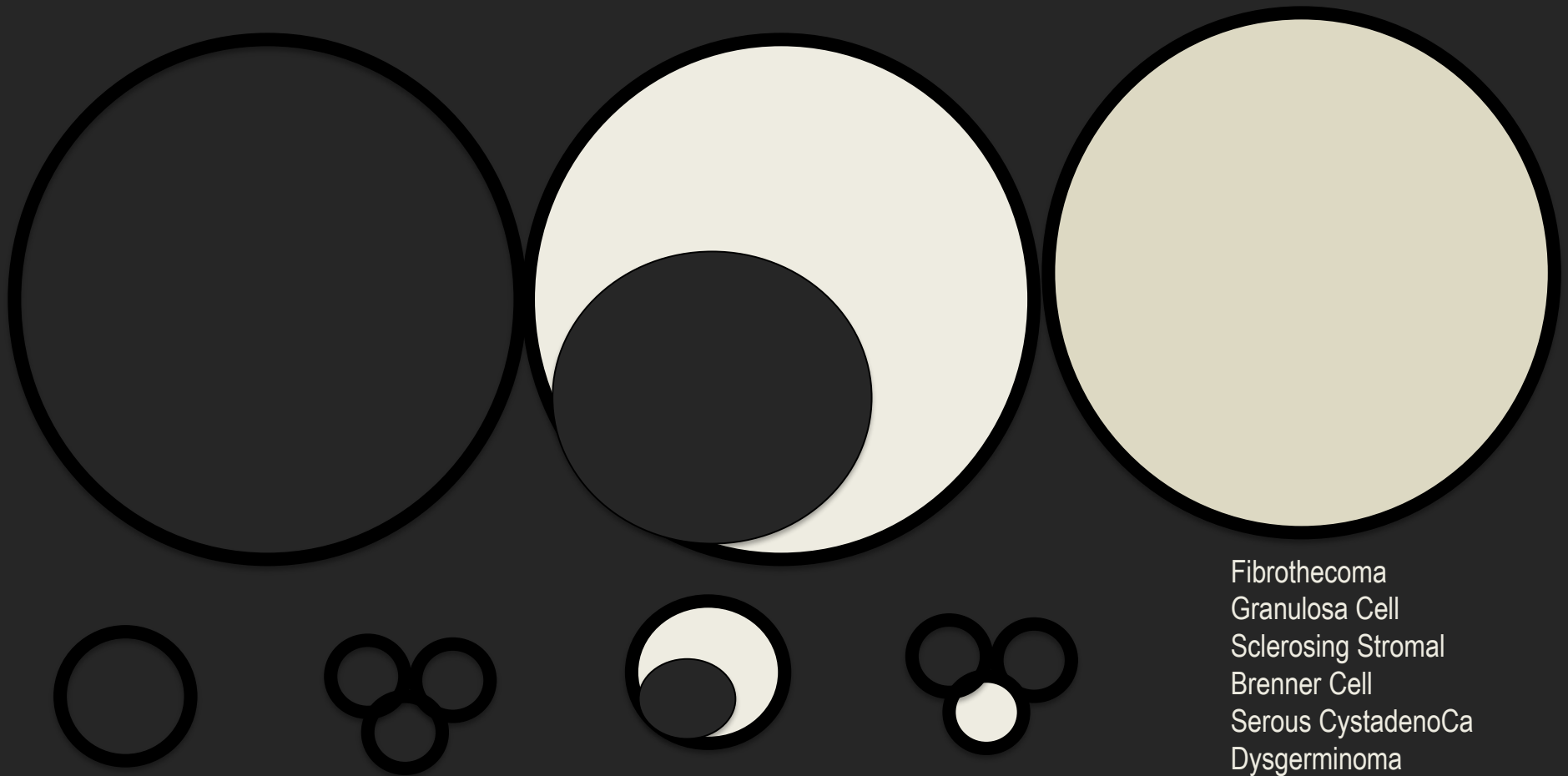
Mature teratoma
Struma ovarii

Serous and Mucinous
Adenocarcinoma
Endometroid Carcinoma
Clear Cell Carcinoma

Granulosa Tumor



Dysgerminoma
Immature teratoma
Endodermal Sinus (Yolk Sac) tumor
Choriocarcinoma
Embryonal Carcinoma



Follicular cyst
Serous
Cystadenoma

Mucinous
Cystadenoma
Tubo-ovarian Abscess
PCOS
Ovarian
Hyperstimulation

Serous
Cystadenocarcioma
Endometroid
Carcinoma
Borderline lesion
Cystadenofibroma

Mucinous
Cystadenocarcinoma
Endometroid Ca
Clear Cell Ca
Cystadenofibroma
Struma Ovarii
Borderline Lesion

Fibrothecoma
Granulosa Cell
Sclerosing Stromal
Brenner Cell
Serous CystadenoCa
Dysgerminoma
Metastasis
Lymphoma

Follicular cyst
Serous Cystadenoma

Mucinous Cystadenoma
Tubo-ovarian Absces
PCOS
Ovarian Hyperstimulation

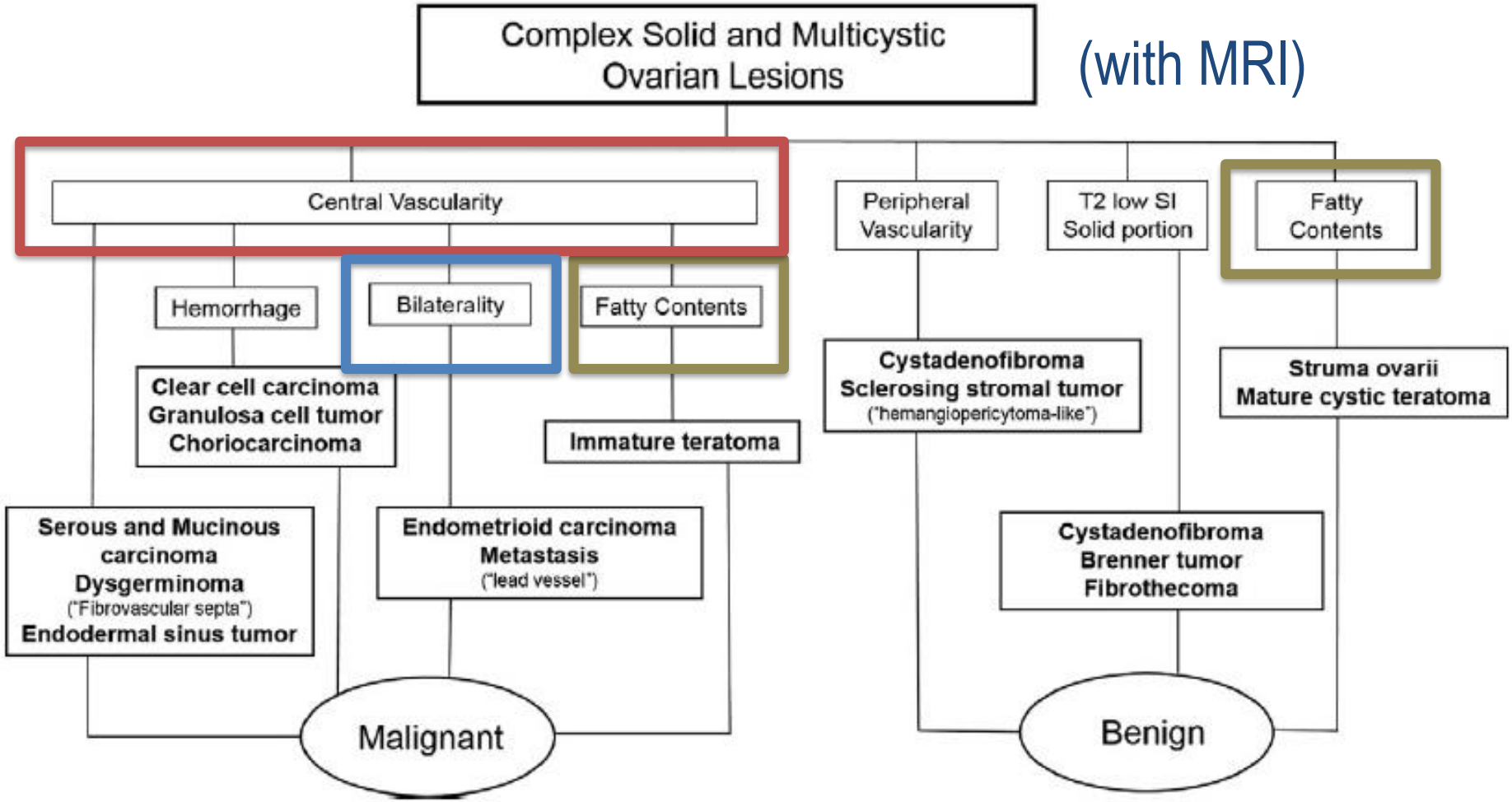
Serous Cystadenocarcioma
Endometroid Carcinoma
Borderline lesion
Cystadenofibroma

Mucinous Cystadenocarcinoma
Endometroid Ca
Clear Cell Ca
Cystadenofibroma
Struma Ovarii
Borderline Lesion

Fibrothecoma
Sclerosing Stromal
Granulosa Cell
Brenner Cell
Serous CystadenoCa
Dysgerminoma
Metastasis
Lymphoma

BWH

VE RI TAS



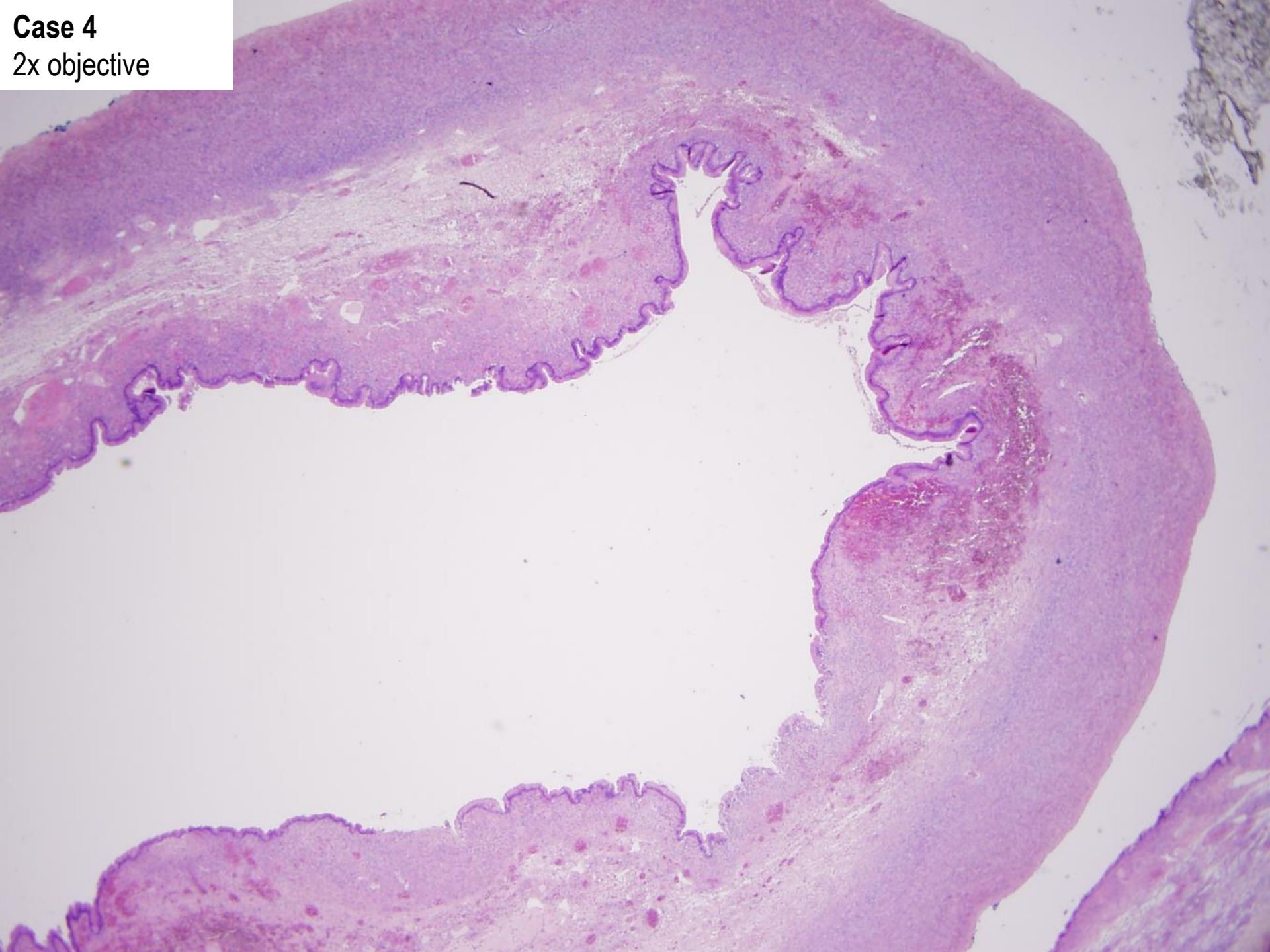
What about CT?

CASE 1

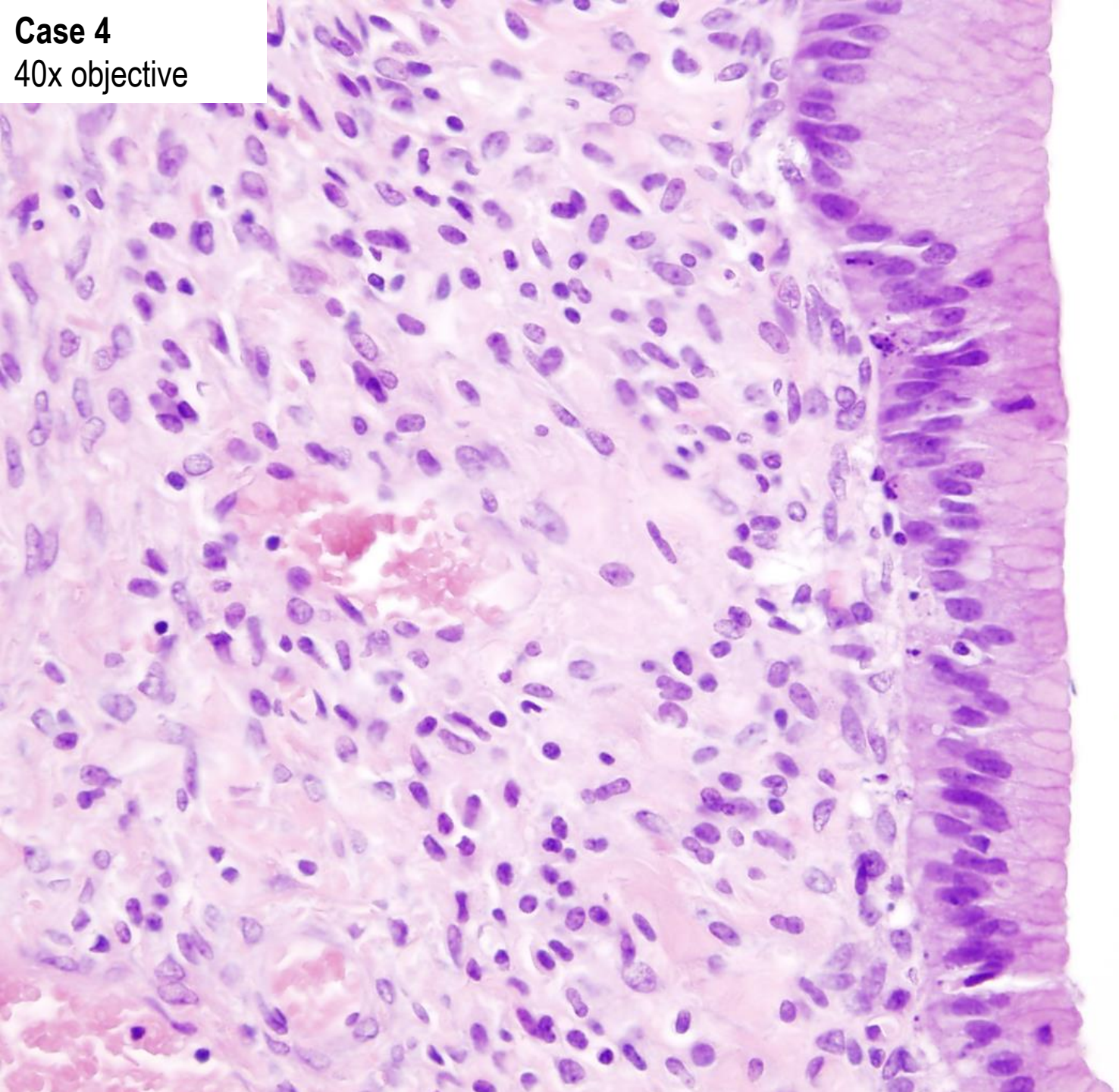
49 year old woman with prior Nissen, presenting to ED with epigastric pain, incidental finding

A

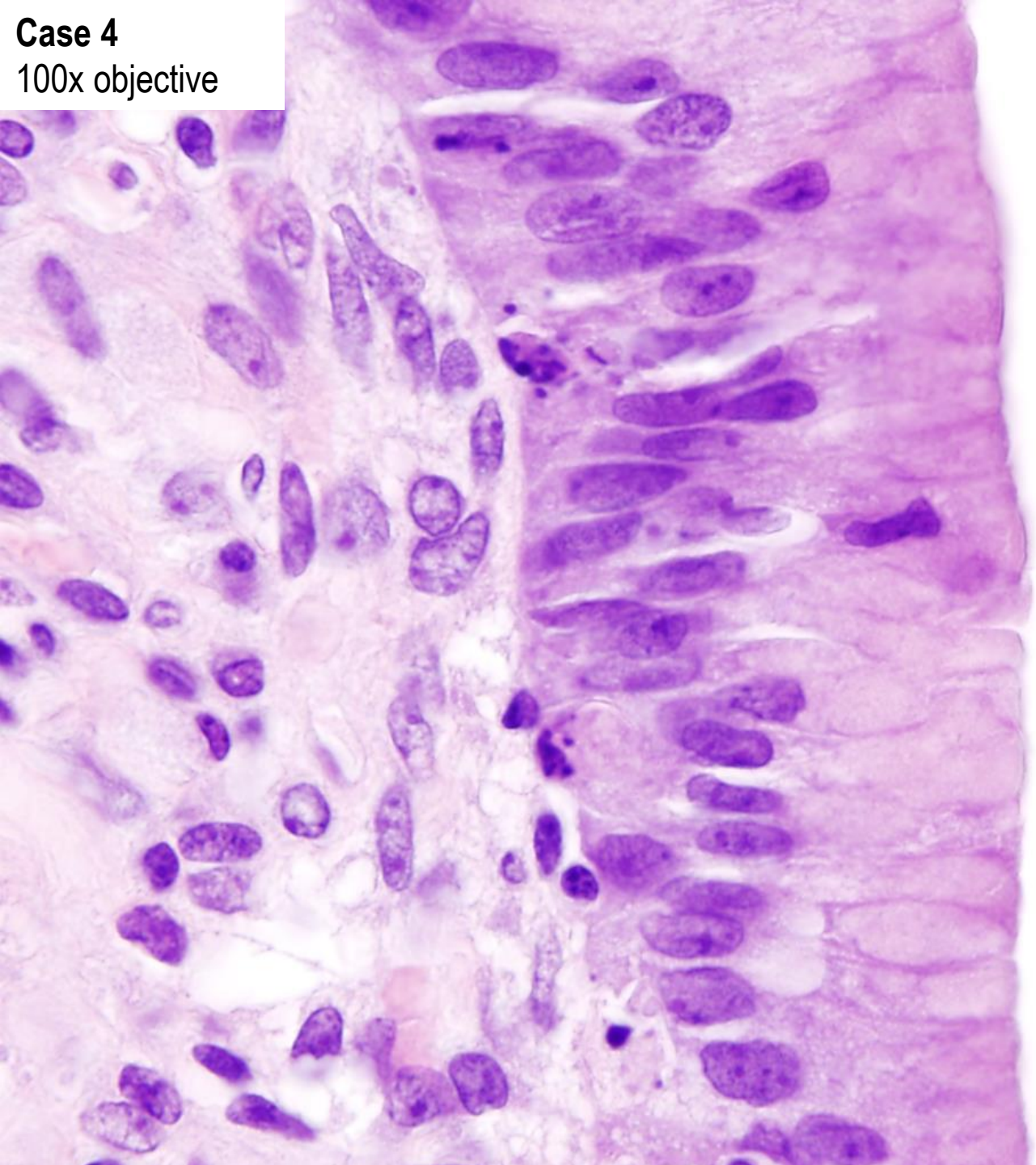
Case 4
2x objective



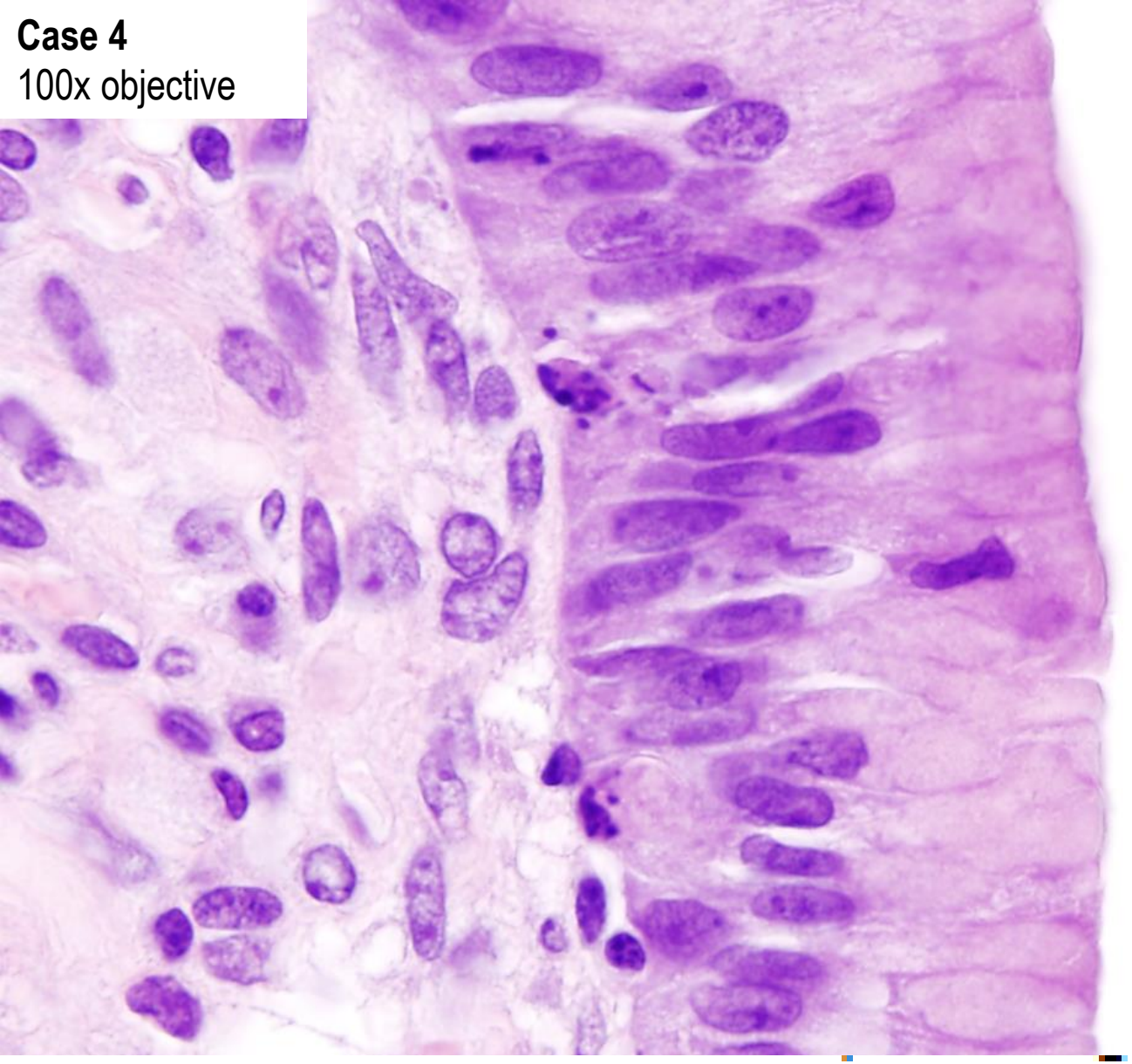
Case 4
40x objective



Case 4
100x objective



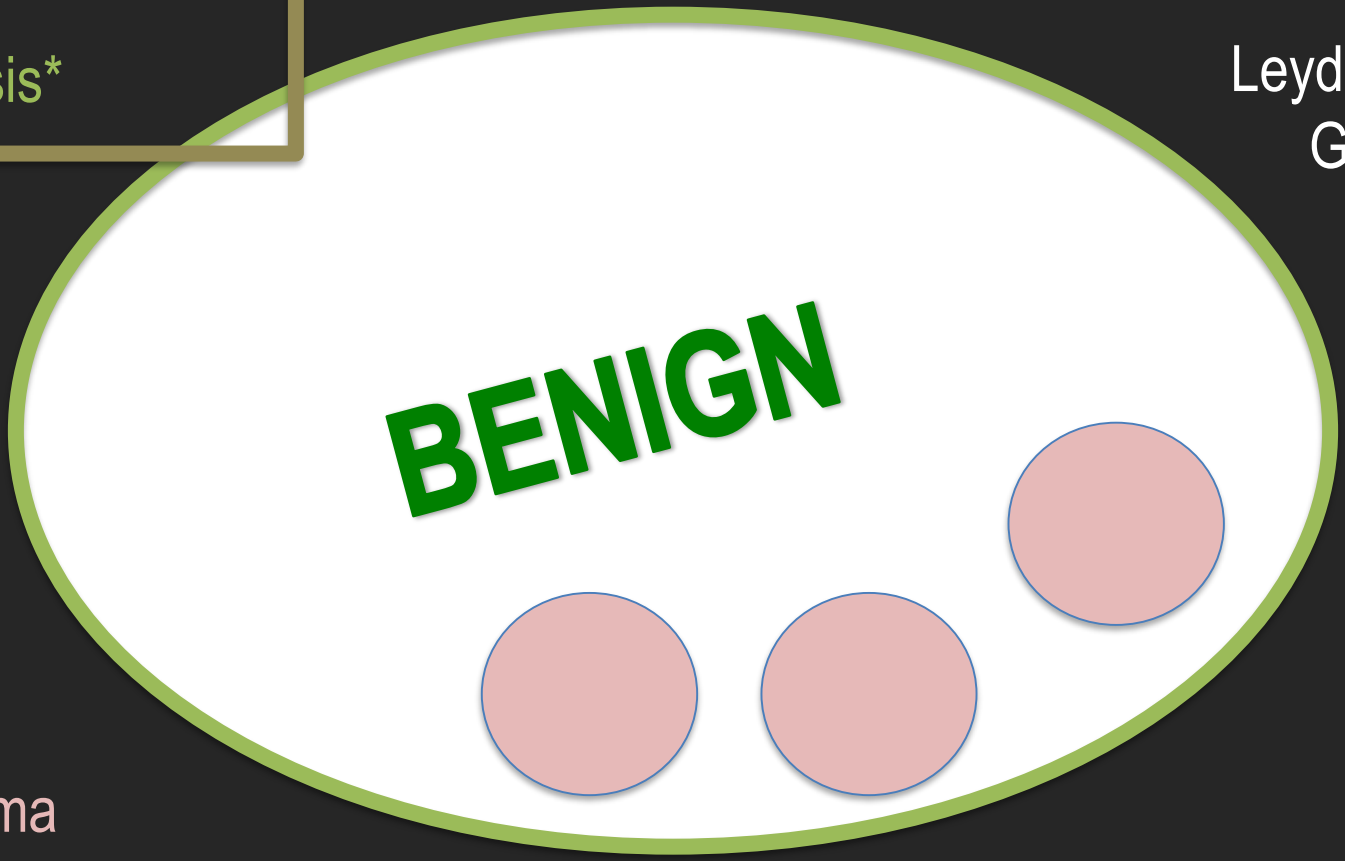
Case 4
100x objective



Right ovary:
Mucinous cystadenoma (3.5 cm).

Serous and Mucinous
Cystadenoma
Brenner Cell
Endometriosis*

Fibroma
Thecoma
Sclerosing Stromal
Tumor
Leydig-Sertoli
Granulosa



Mature teratoma
Struma ovarii

Mucinous Cystadenoma

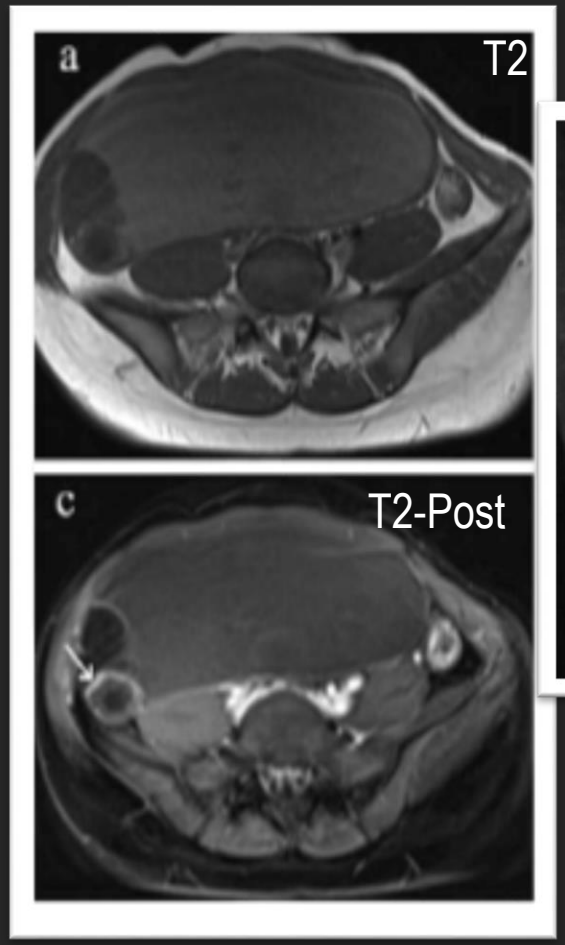
Mucinous Cystic Tumors may be Benign, Borderline, or Malignant

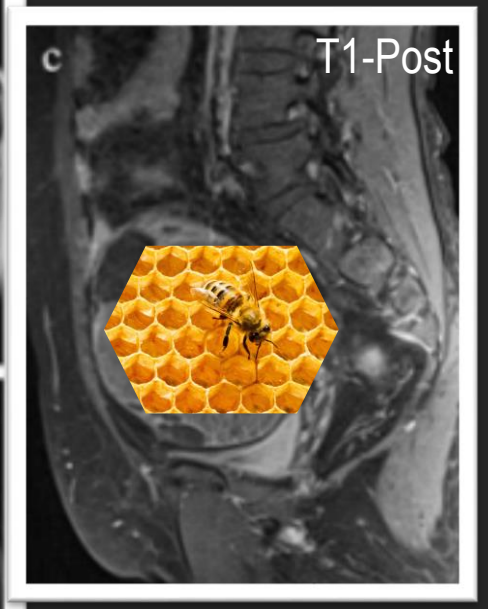
Benign vs. Borderline affects surgical management

US and CT have limited sensitivity and specificity

MR features of Borderline MC

- "Honeycomb" loculi with low T2/high T1 signal
- Septation **or** vegetation >5mm
- >1 Feature = Specificity (92%)





BWH

VE RI TAS

What % of Borderline Mucinous Tumors are “Advanced” at diagnosis?

5%

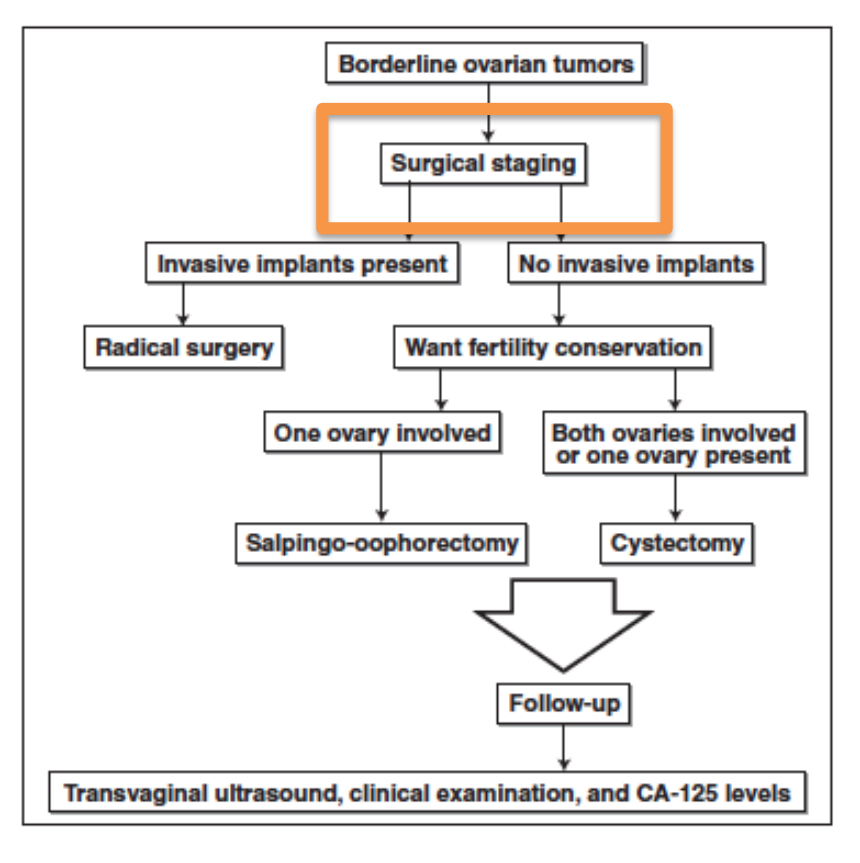
10%

20%

80%

82% of cases are stage I; 5-year survival is up to 99–100%

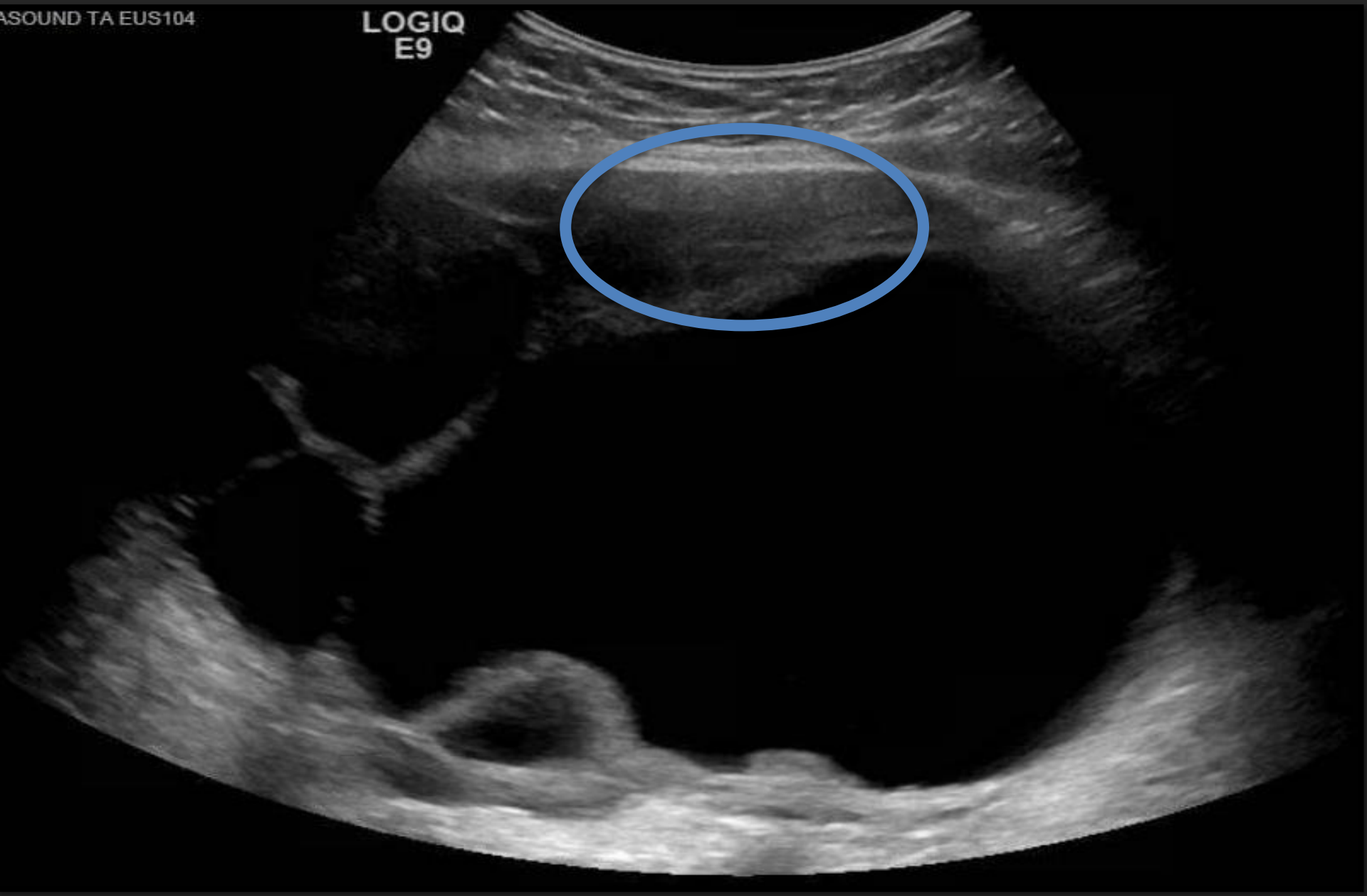
18% of cases are advanced stages; mortality may reach up to 50% depending on stage

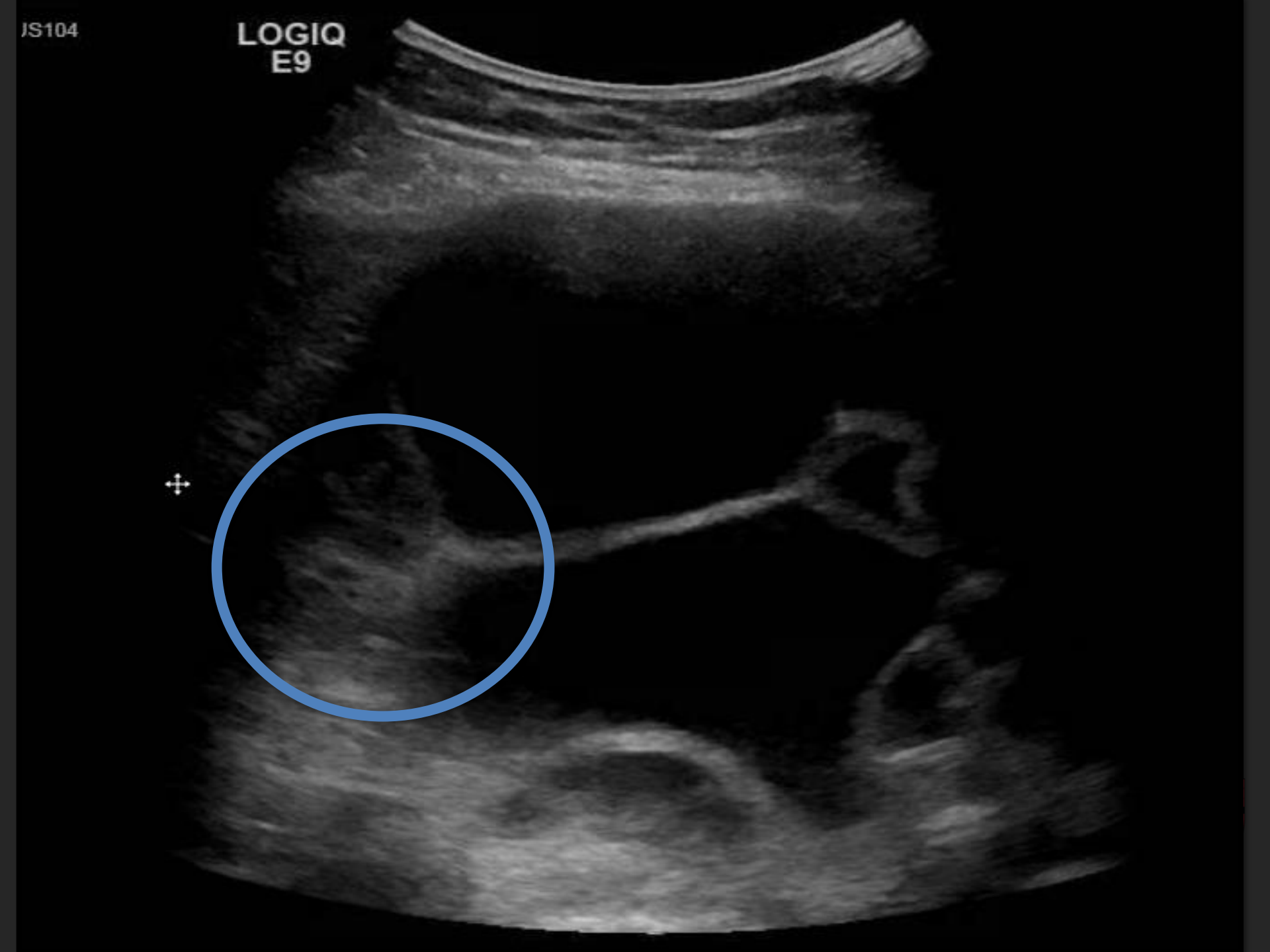


CASE 2

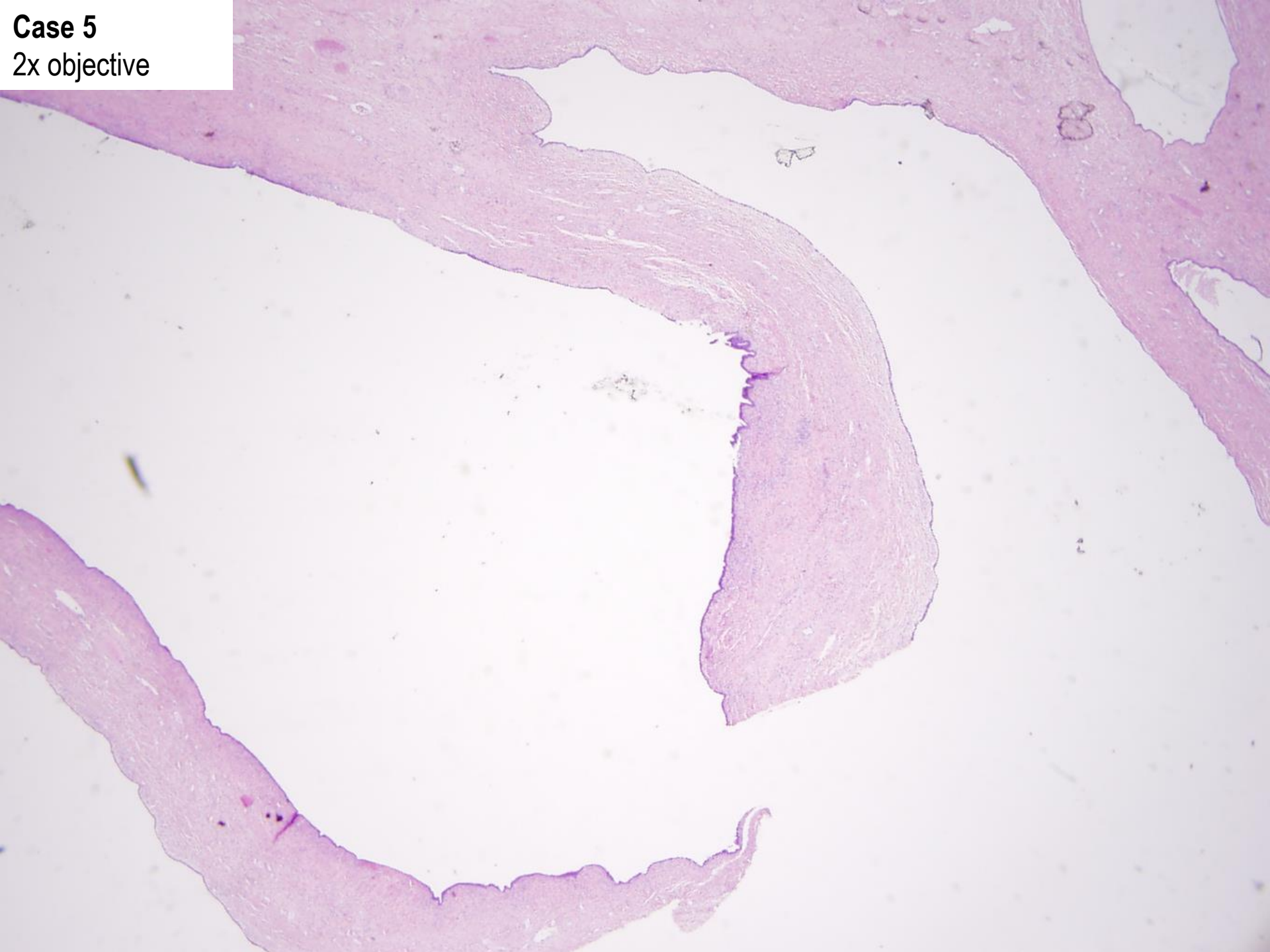
59 year old woman, prior TAH and right salpingectomy, presenting with LLQ pain, nausea, vomiting

L

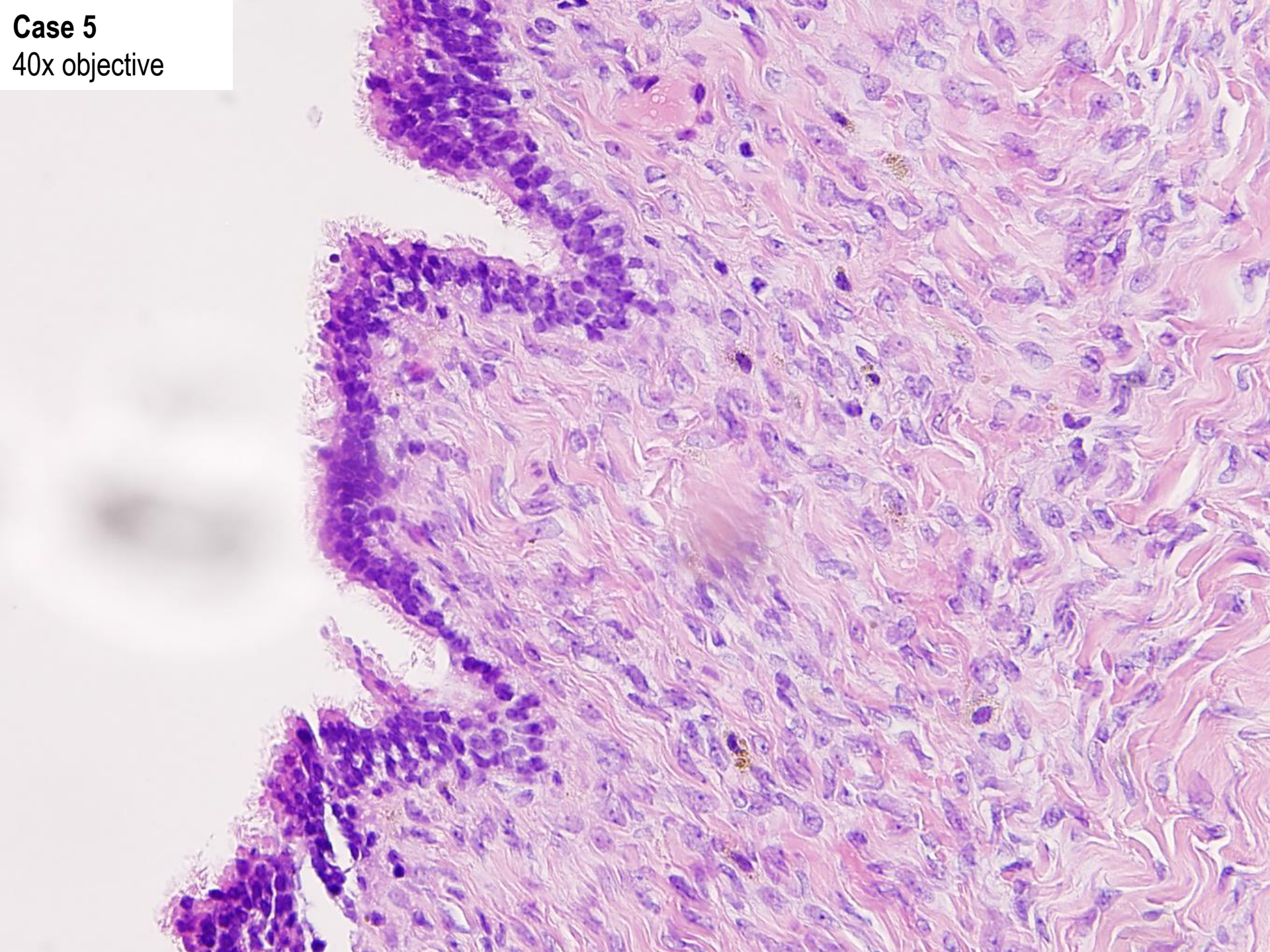

ASOUND TA EUS104
LOGIQ
E9


JS104
LOGIQ
E9

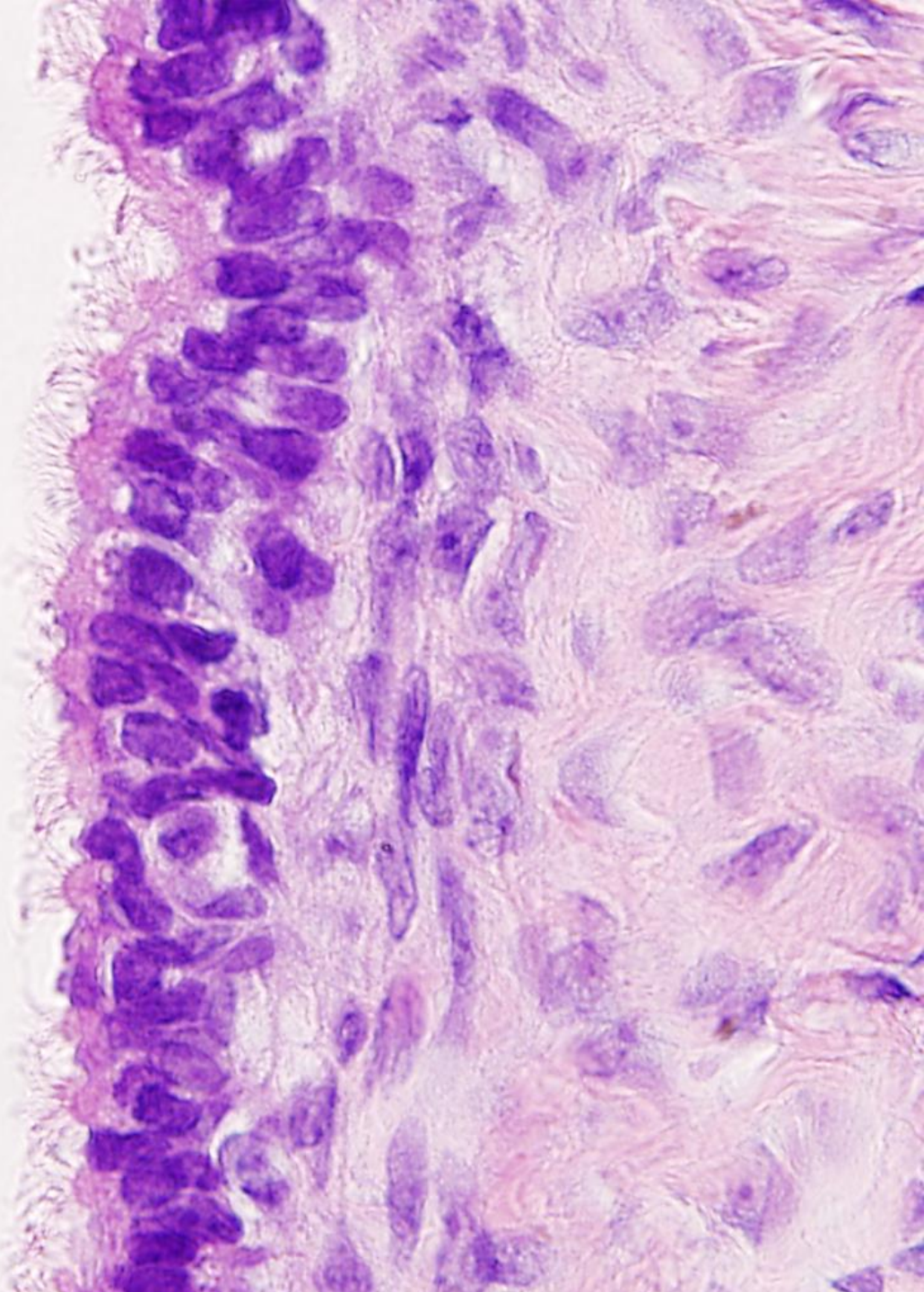
Case 5
2x objective



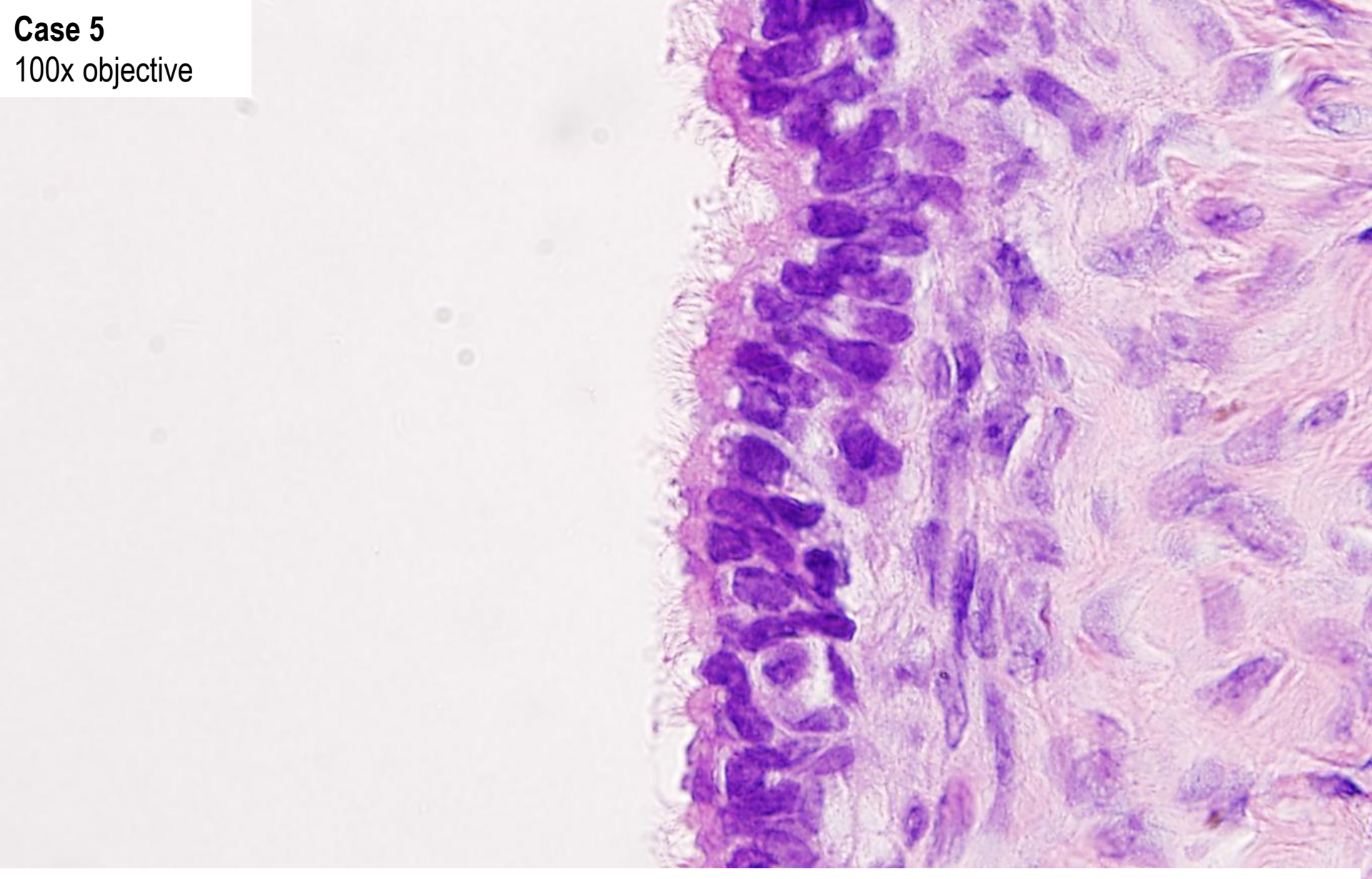
Case 5
40x objective



Case 5
100x objective



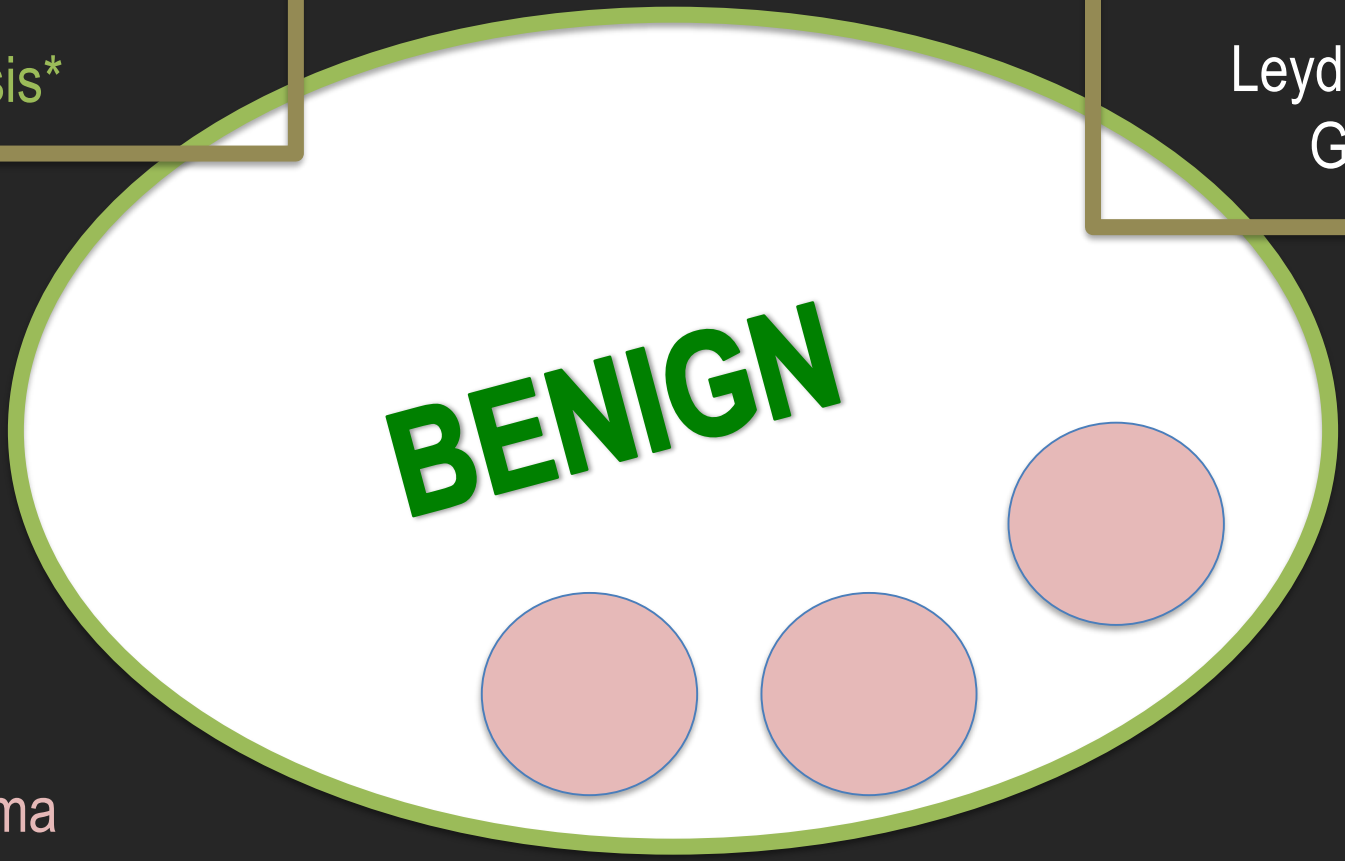
Case 5
100x objective



LEFT PELVIC MASS (including FSA):
Serous cystadenofibroma of ovary (19.0 cm), with degenerative changes consistent with torsion.

Serous and Mucinous
Cystadenoma
Brenner Cell
Endometriosis*

Fibroma
Thecoma
Sclerosing Stromal
Tumor
Leydig-Sertoli
Granulosa



Mature teratoma
Struma ovarii

Fibrous Ovarian Neoplasms

Ovarian lesion	Population	Nature	Potential associated clinical features	Relevant MRI findings
Fibroma/fibrothecoma	All ages	Solid	Pleural effusion – ascites (Demons–Meigs' syndrome)	Homogeneous low signal on T2 images, weak enhancement
Brenner tumour	Pre-menopausal women	Solid	Usually asymptomatic	Homogeneous low signal on T2 images, at least moderate enhancement
Leydig cell tumour	Post-menopausal women	Solid	Virilization	Presence of lipid components, intense enhancement of non-fibrotic portions
Cystadenofibroma	All ages	Solid and cystic	Usually asymptomatic	"Black sponge" aspect, dark-signal thickening of cysts' wall
Granulosa cell tumour	Middle-aged and post-menopausal women	Solid and cystic	Excessive oestrogen production (vaginal bleeding)	Complex mass with haemorrhagic cysts, endometrial thickening, or polyps
Krukenberg tumour	All ages	Solid and cystic	Tumour of the gastrointestinal tract, carcinomatous ascites	At least moderate enhancement of solid components, peritoneal implants, ascites

COMMON FEATURE:

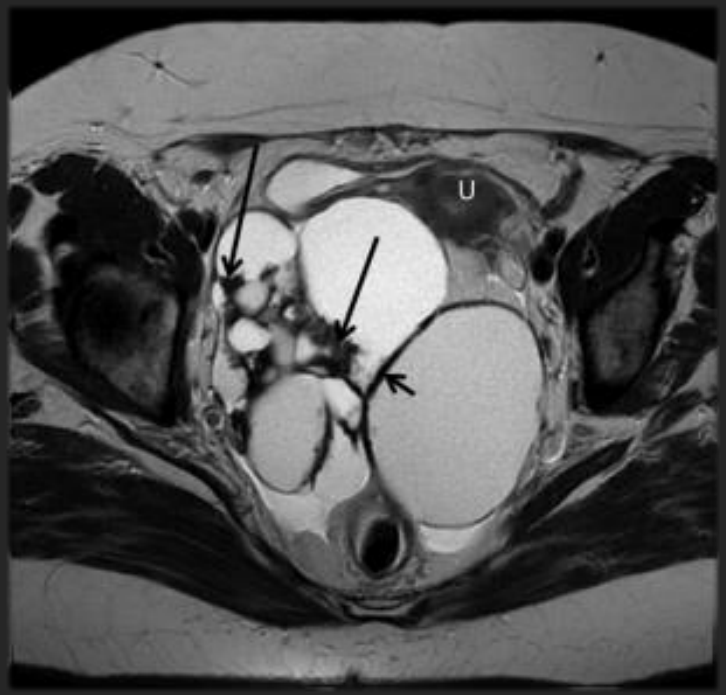
LOW T2 Signal with minimal (at most) enhancement

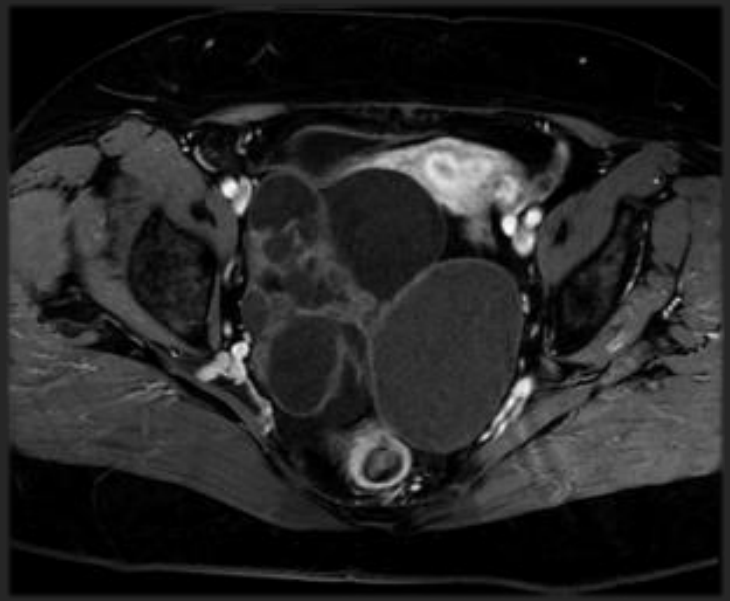
MRI Features of Cystadenofibroma

Multiloculated cystic component (T2 SI HIGH)

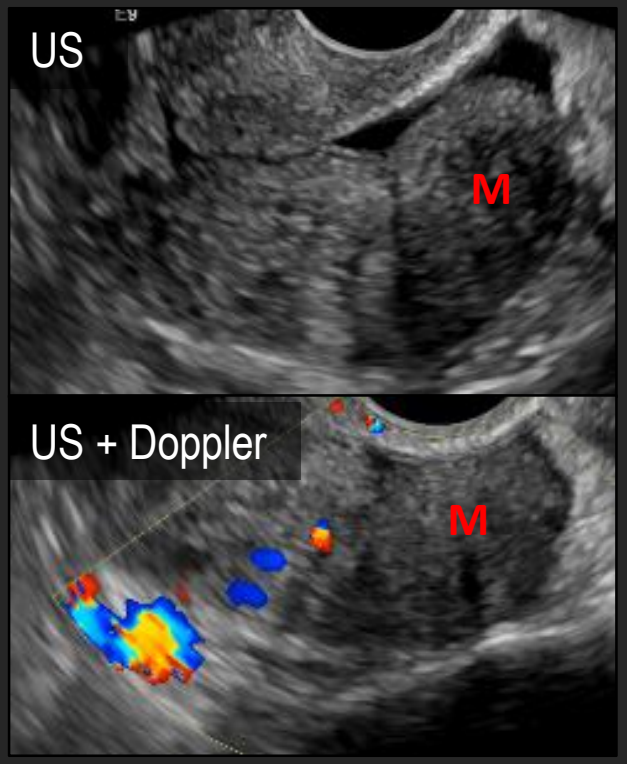
Fibrous stroma (T2 SI LOW)

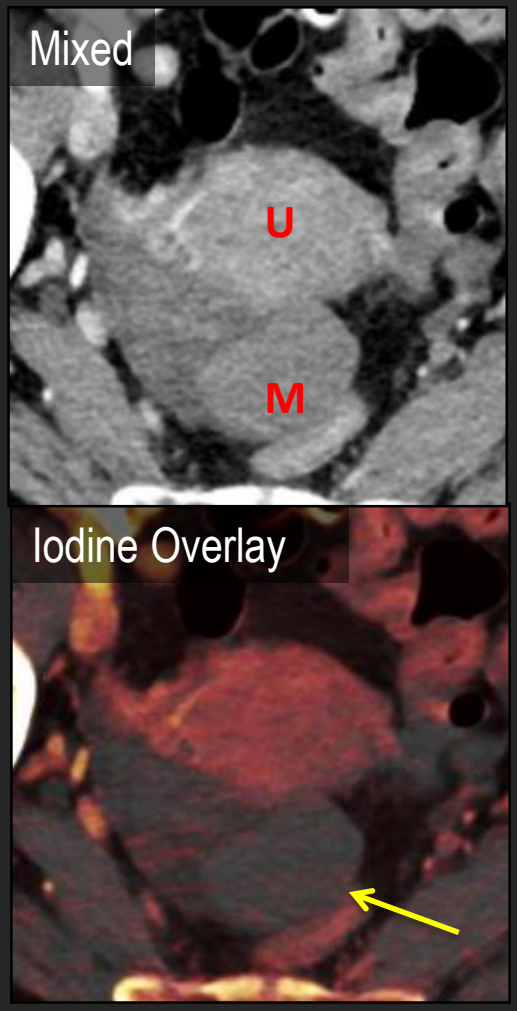
NO Gadolinium enhancement of stroma





Companion Case





TORSION

Other than torsion, fibroma/fibrothecoma is associated with which syndrome?

Meigs Syndrome

Neurofibromatosis Type I and II

Gorlin Syndrome

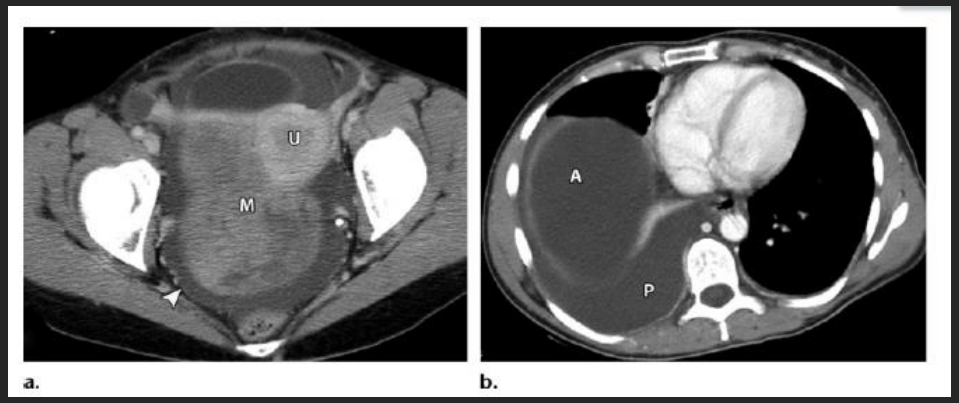
Carcinoid Syndrome

Behcet Disease

Ovarian Fibroma Syndromes

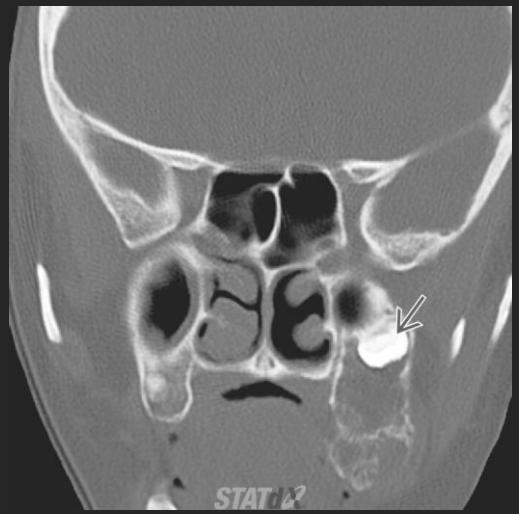
Meigs Syndrome

- Ascites and hydrothorax associated with solid ovarian lesion (>80% are fibroma)
- 70% right sided, unilateral



Gorlin Syndrome

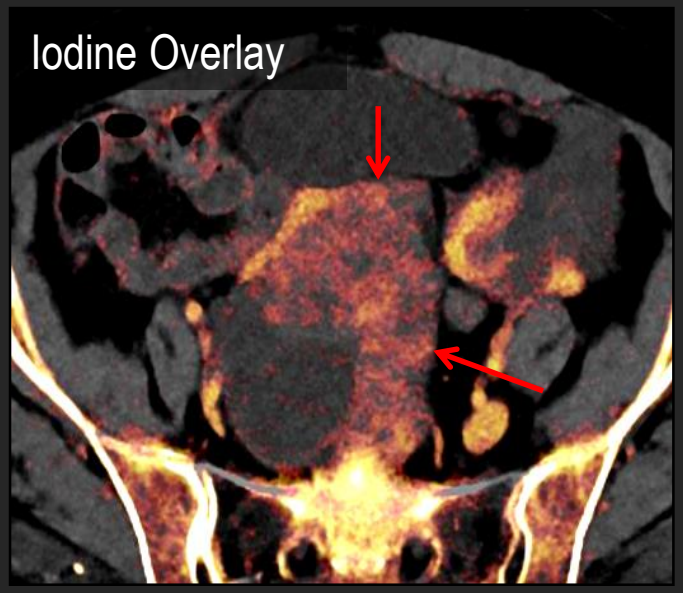
- "Basal Cell Nevus Syndrome"
- Multiple BCC in young patients
- Major Criteria
  - Odontogenic keratocysts
  - Cerebral falx calcification
  - Rib anomalies

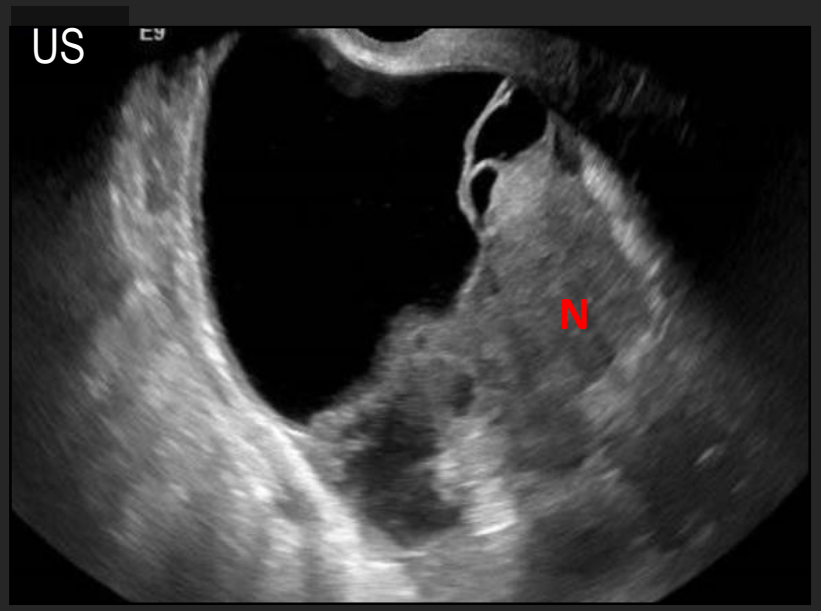


CASE 3

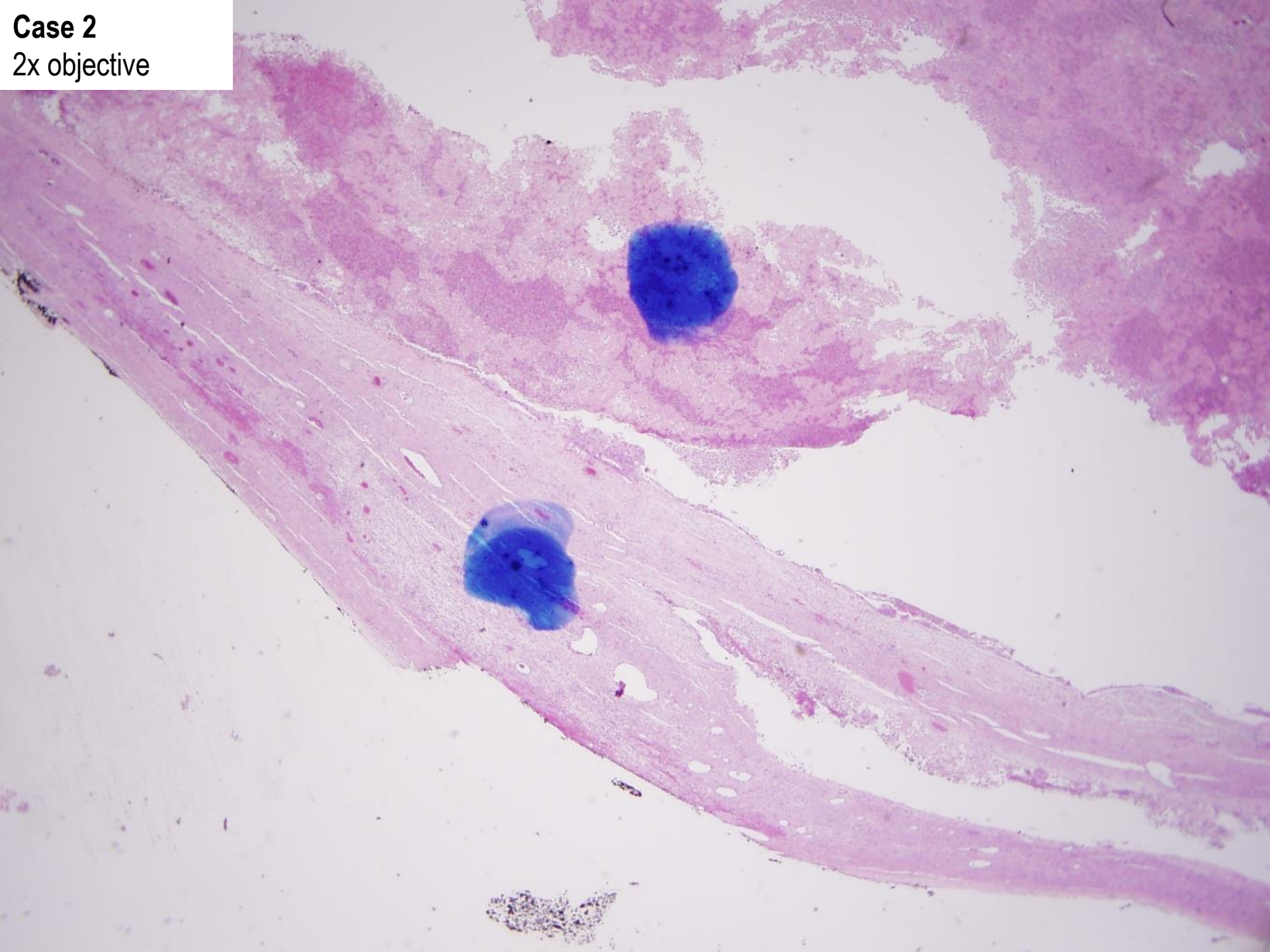
49 year old woman presenting with bloating and abdominal distention

Mixed

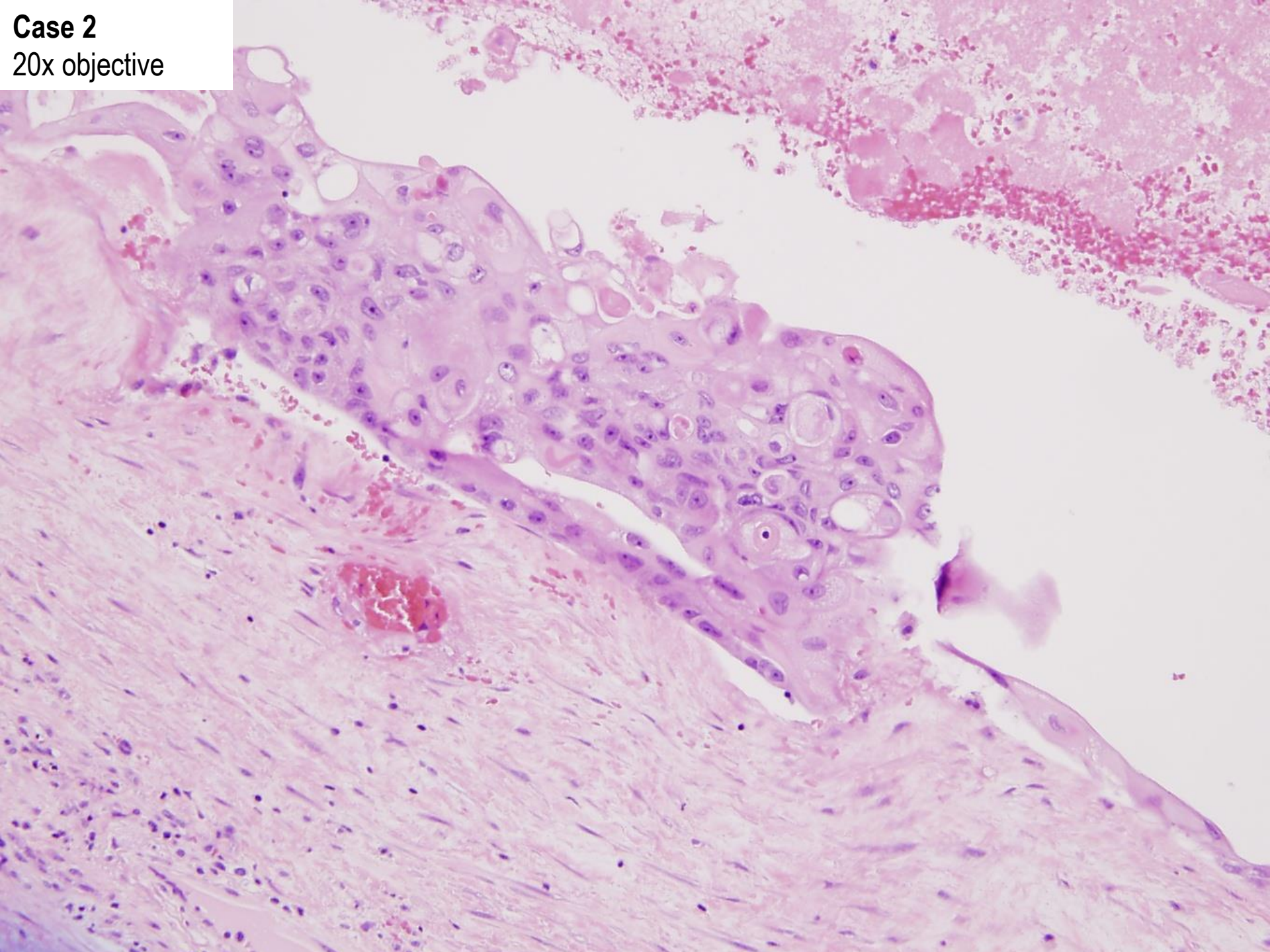

Iodine Overlay


US
N

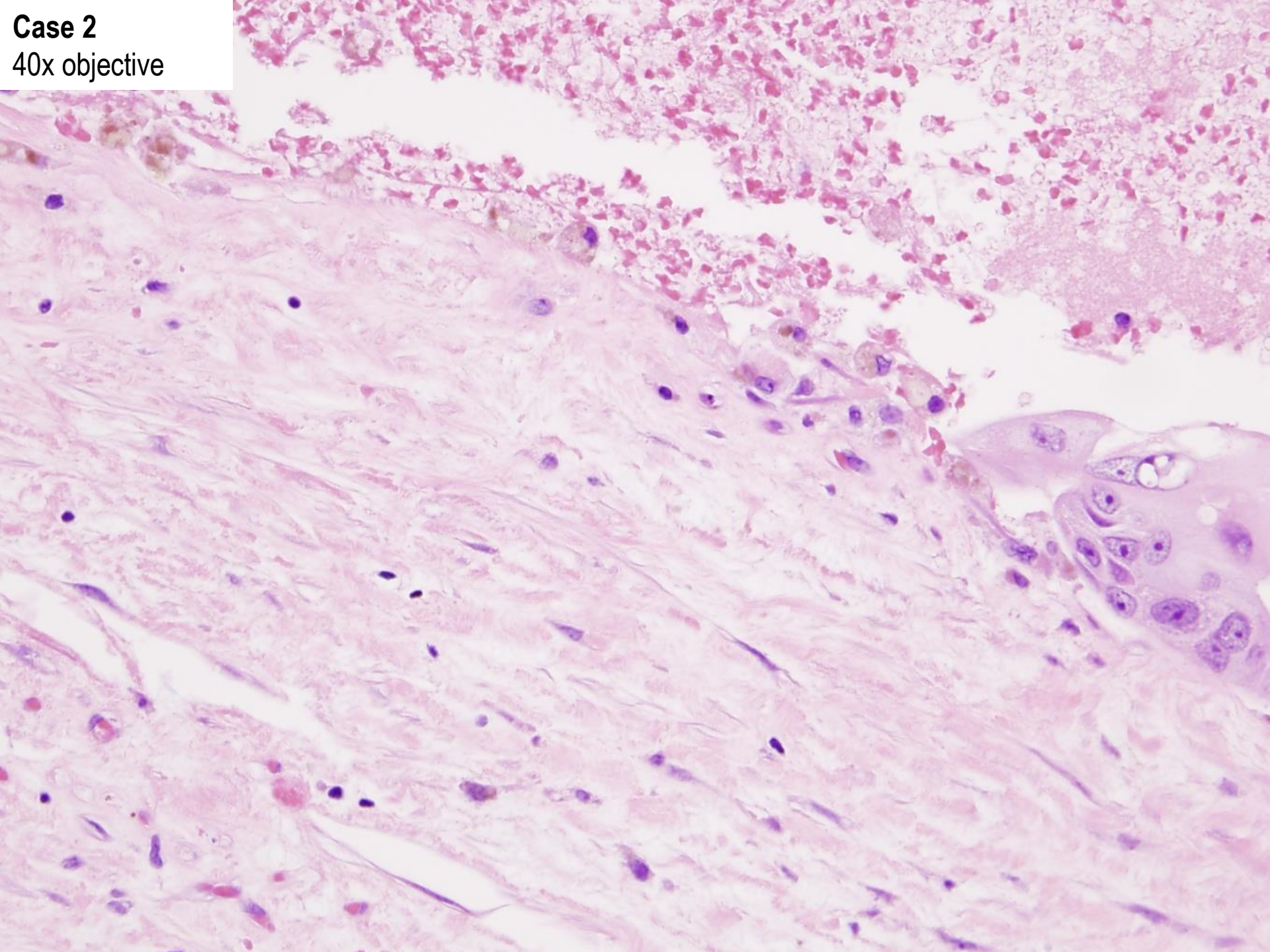
Case 2
2x objective



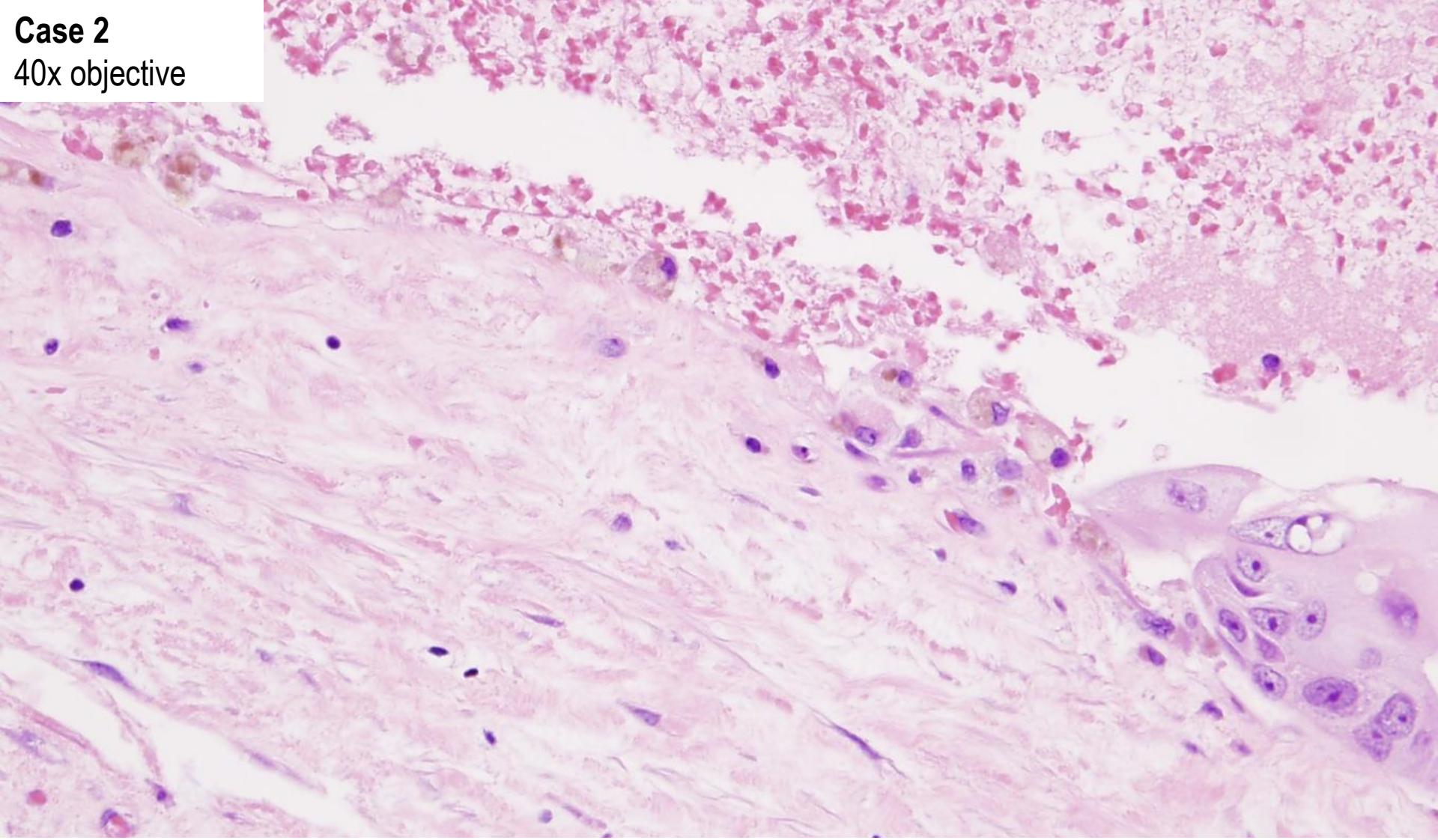
Case 2
20x objective



Case 2
40x objective

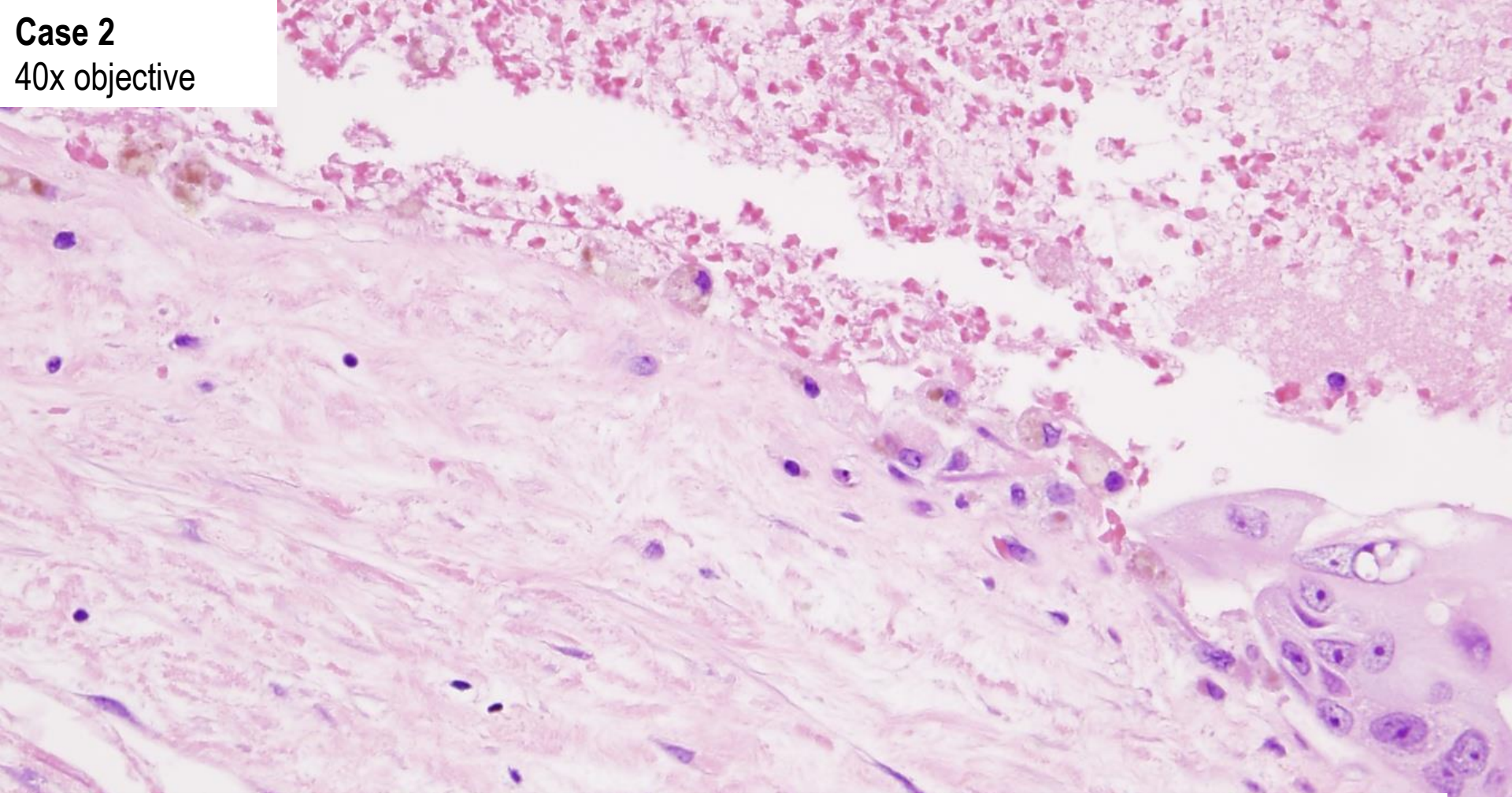


Case 2
40x objective



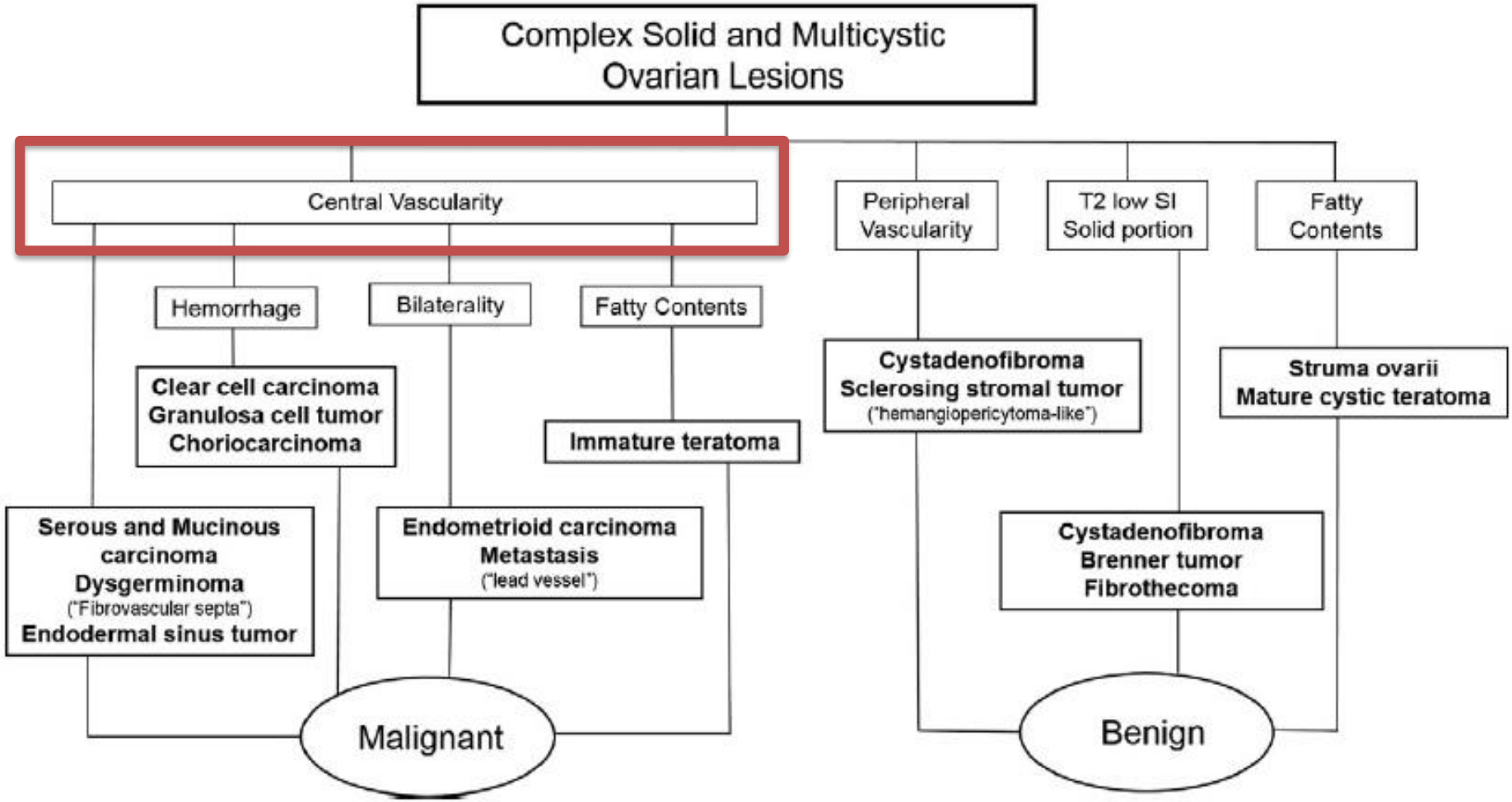
Ovary:
MULLERIAN ADENOCARCINOMA with squamous differentiation demonstrating treatment effect, present within a 8.0 cm tumor bed consisting of hemorrhage, chronic inflammation, and hemosiderin-laden macrophages. (See NOTE below).

Case 2
40x objective



Immunohistochemistry performed at the outside institution and reviewed at BWH demonstrates the following staining profile in lesional cells:

Positive - p16 (patchy), p53 (null mutant), pankeratin,
ER (>90%, moderate to strong)
Negative - calretinin, WT1


Complex Solid and Multicystic Ovarian Lesions
Central Vascularity
Peripheral Vascularity
T2 low SI Solid portion
Fatty Contents
Hemorrhage
Bilaterality
Fatty Contents
Clear cell carcinoma
Granulosa cell tumor
Choriocarcinoma
Immature teratoma
Cystadenofibroma
Sclerosing stromal tumor
("hemangiopericytoma-like")
Struma ovarii
Mature cystic teratoma
Serous and Mucinous carcinoma
Dysgerminoma
("Fibrovascular septa")
Endodermal sinus tumor
Endometrioid carcinoma
Metastasis
("lead vessel")
Cystadenofibroma
Brenner tumor
Fibrothecoma
Malignant
Benign

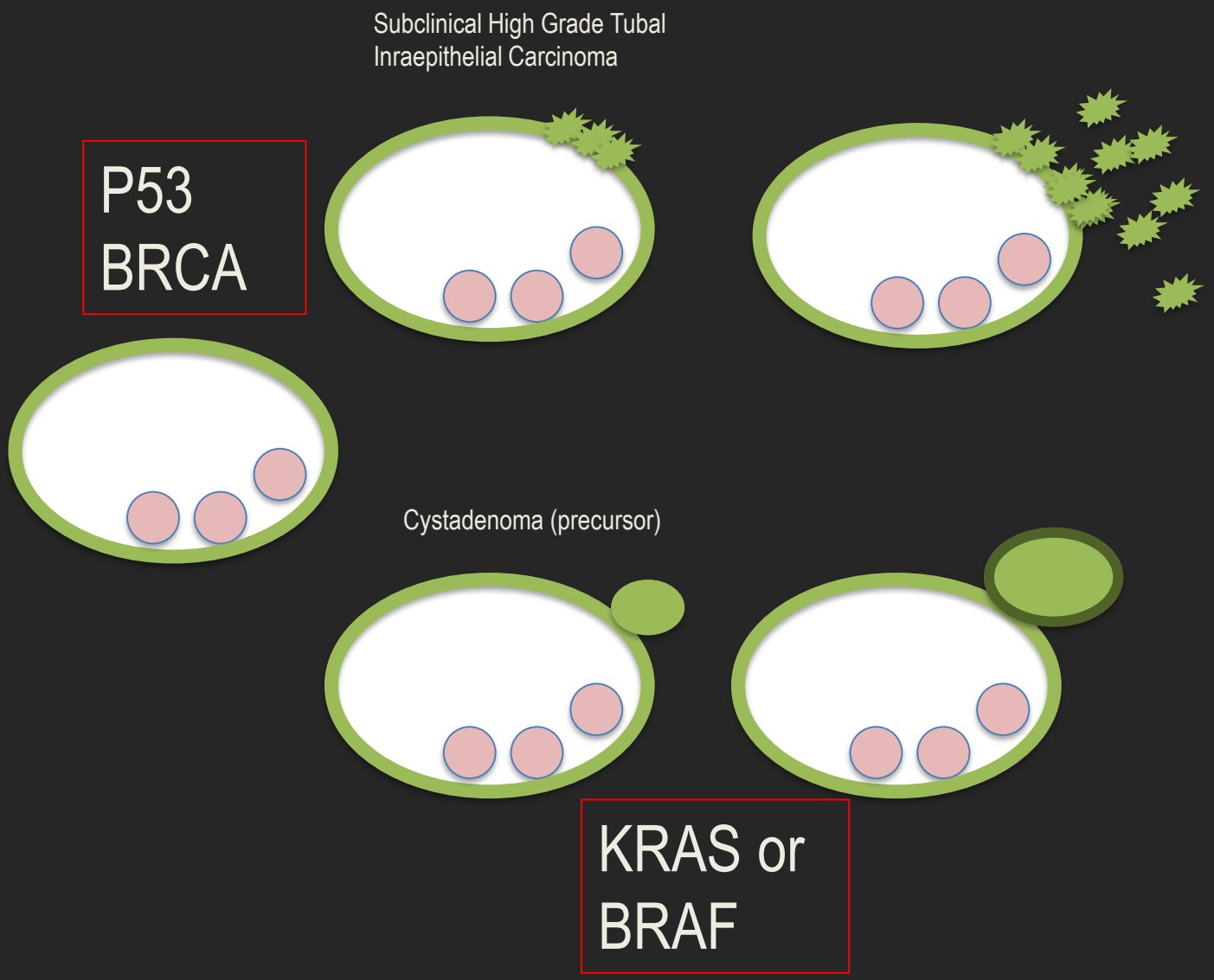
Ovarian Epithelial Carcinoma (OEC)

- 6th most common female cancer in the USA
- 70% diagnosed at advanced stage
- Stage I: 80% 5 year survival
- Stage IV: 15% 5 year survival
- Radiographically:
  - -US high sensitivity (>88%), low specificity (40-80%)
  - -CT: Ideal for staging
  - -MRI: Superior for characterization

Table 4: FIGO Staging of Ovarian Tumors

Stage	Description
1	Confined to ovary(ies)
2	Peritoneal Implants within pelvis
3	Peritoneal Implants beyond pelvis
4	Liver or extraperitoneal

OEC: Two Distinct Diseases?



HIGH GRADE
Serous or
Mucinous
Carcinoma

LOW GRADE
Serous or
Mucinous
Carcinoma

Hereditary Ovarian Cancer Syndromes

Table 1
Features of Hereditary Ovarian Cancer Syndromes

Syndrome	Genetic Abnormality and Chromosome Locus*	Function Affected	Subtype of Ovarian Cancer	Associated Cancers	Lifetime Risk of Ovarian Cancer (%)
BRCA1	*BRCA1* [17q21]	DNA repair, mRNA	HGSC	Female breast (87%), cervical (3.6%), uterine (2.5%), colon	40–50
BRCA2	*BRCA2* [13q12.3]	DNA repair, mRNA	HGSC	Female breast (84%), male breast (7%), prostate (7.5%), gallbladder	20–30
HNPCC	*MSH2; MLH1, -2, -6* [3p21, 2p21]	DNA mismatch repair	Serous, endometrioid	Endometrial, colorectal, renal pelvic–ureteral, hepatobiliary	>12

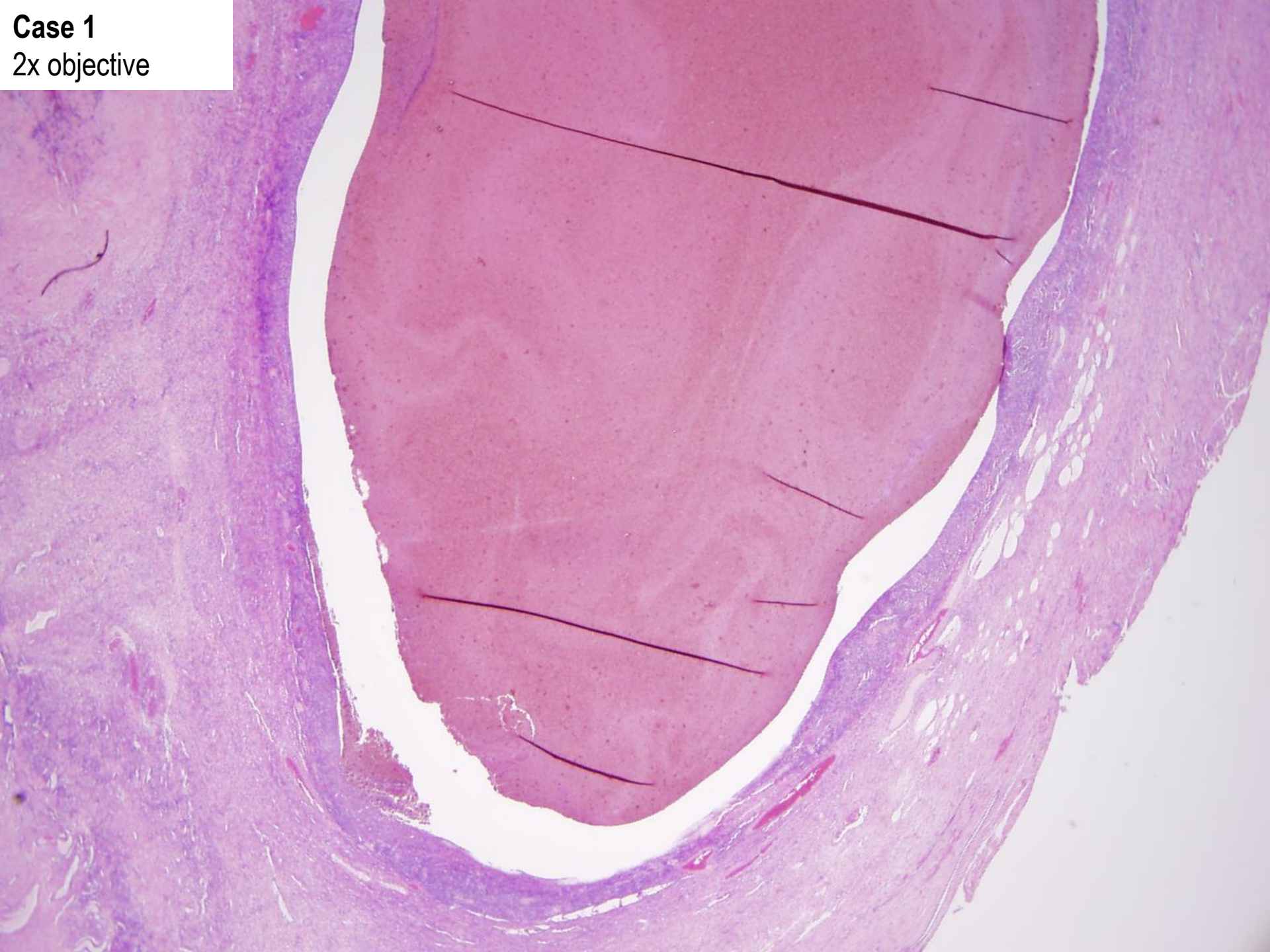
*Information in brackets indicates chromosome loci.

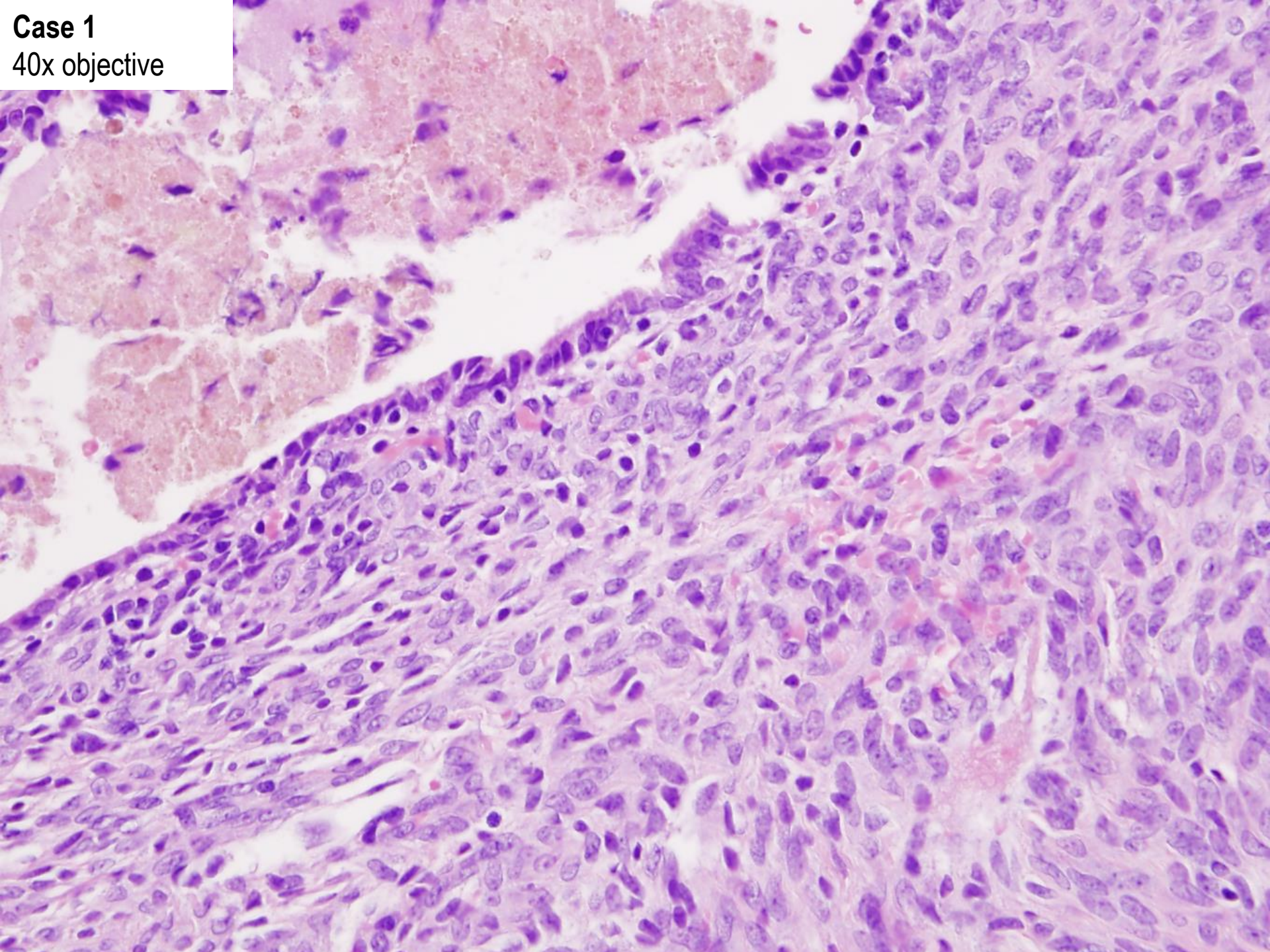
CASE 4

24 year old woman presenting with right flank pain, elevated CA-125

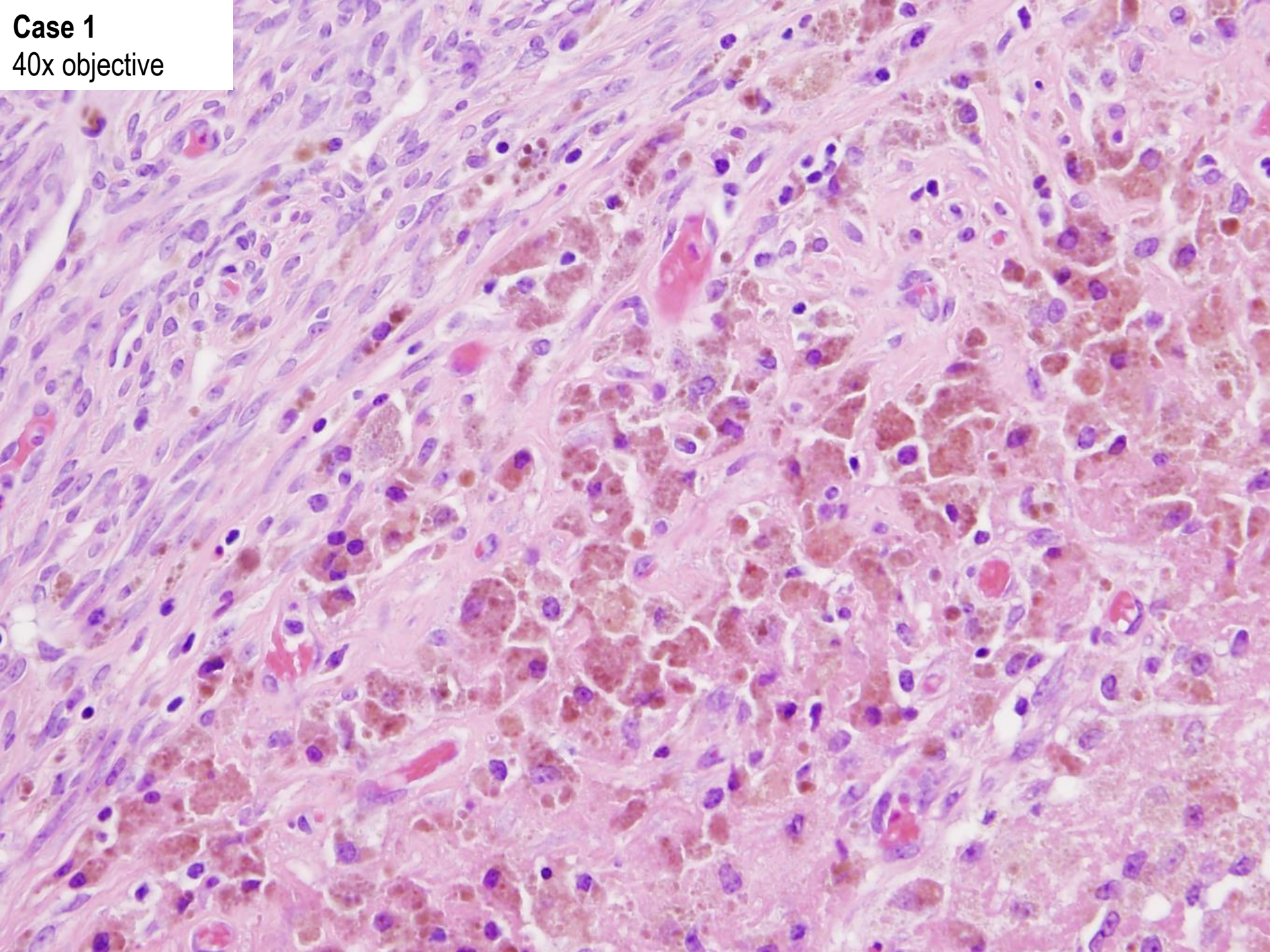
UND TA EUS104
LOGIQ
E9
EUS104
LOGIQ
E9

Case 1
2x objective

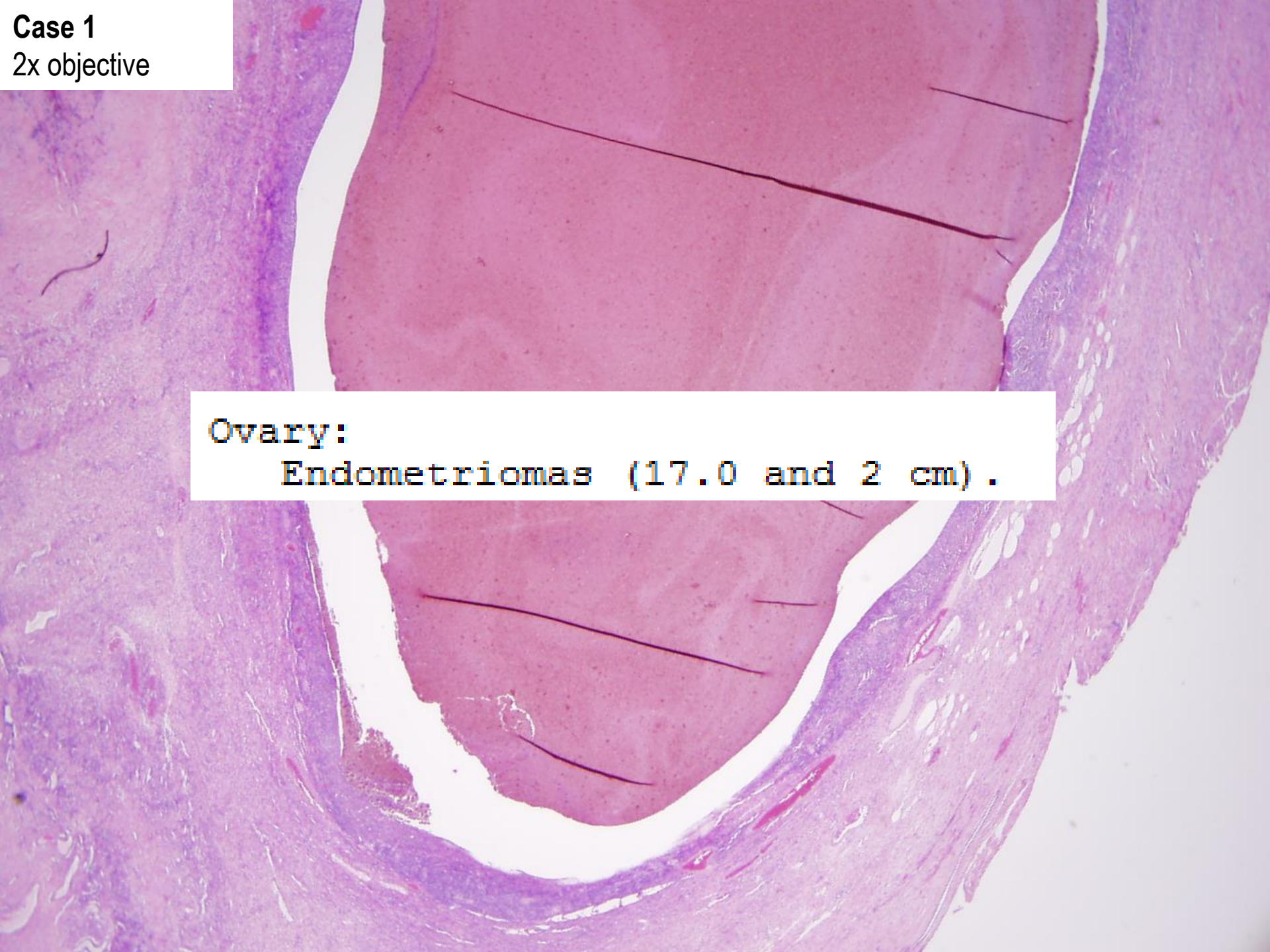



Case 1
40x objective

Case 1
40x objective



Case 1
2x objective



Endometriosis

Affects up to 10% of women; 90% of women with chronic pelvic pain, 50% of infertility patients

3 theories of pathogenesis:

- Metastatic, Metaplastic, Inductive

3 anatomic variants:

- Ovarian, superficial/peritoneal, deep/infiltrative

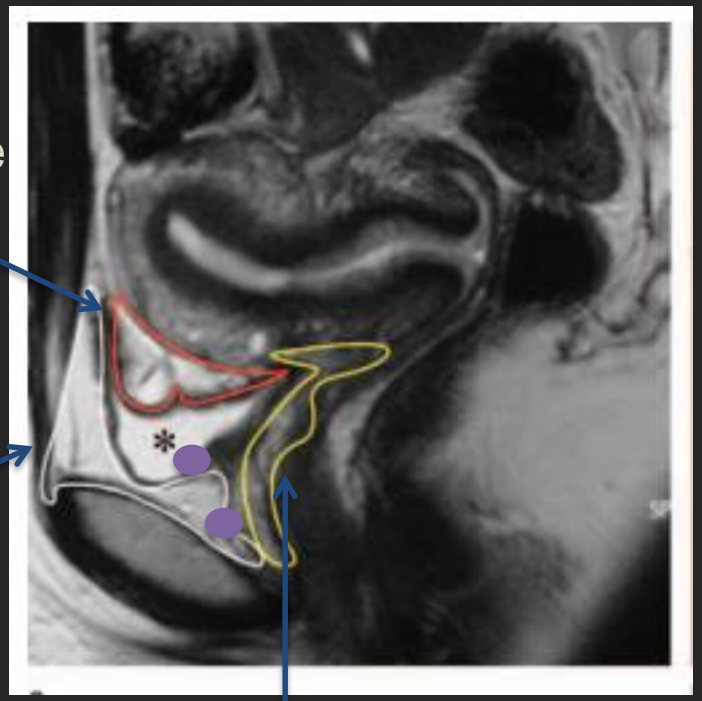
May cause abnormal CA-125 levels

US: hypoechoic, solid, hypovascular,

Sagittal Pelvic Anatomy

ANTERIOR COMPARTMENT

POSTERIOR COMPARTMENT

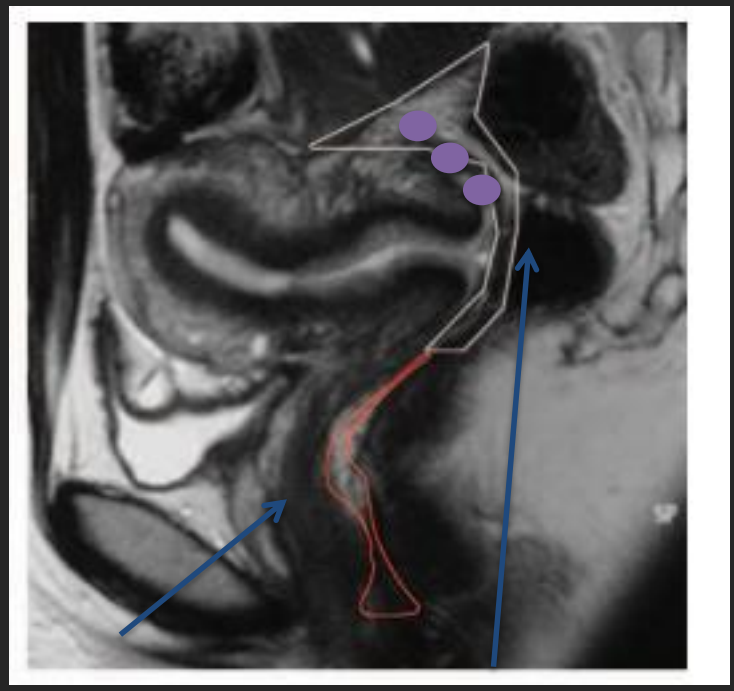


Vesicouterine Pouch

Prevesical Space

Other Anterior Compartment Sites:
-Urinary bladder
- urethra
-round ligament/canal of Nuck

Vesico-Vaginal Septum



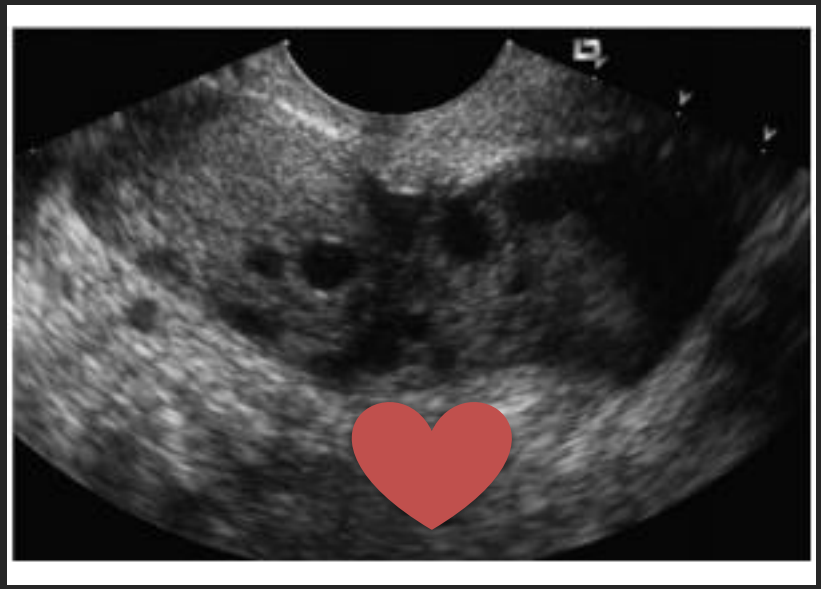
Recto-Vaginal Septum

Recto-Vaginal Pouch (Douglas)

Other Posterior Compartment Sites:
-Ureterosacral ligament
-Posterior broad ligament
-Sigmoid colon

Which radiographic sign is accurate for posterior compartment endometriosis?

- Sliding Uterus Sign
- Kissing Ovaries Sign
- “Just friends” ovary sign
- “Long-term relationship” ovary sign



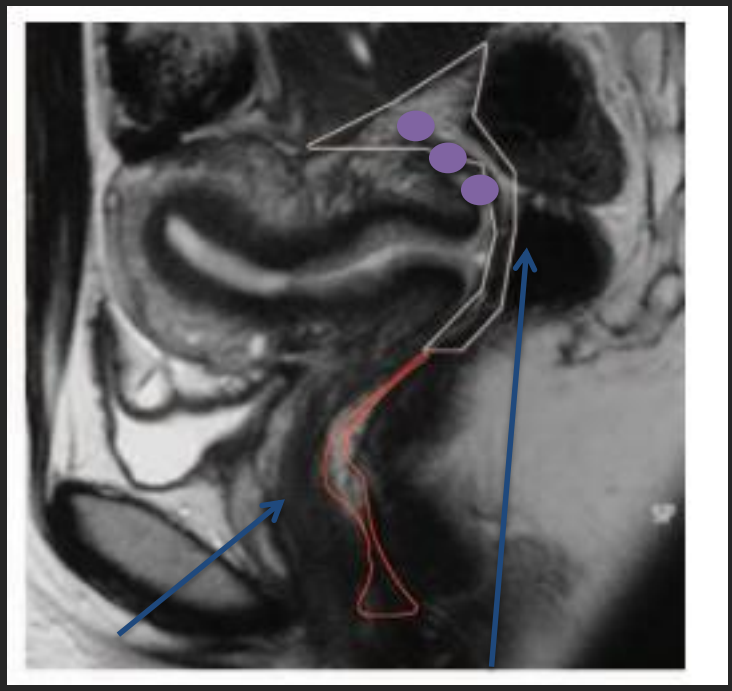
“Sliding Uterus Sign”

POSTERIOR COMPARTMENT

Vaginal transducer in posterior fornix and withdrawn while exerting external abdominal pressure with opposite hand

Immobility of rectum against vaginal and uterus indicates intervening adhesions

Sensitivity 85%, specificity 96%



Recto-Vaginal Septum

Recto-Vaginal Pouch (Douglas)

MRI Pearls for Endometriosis

1. Mutliple T1 bright adnexal cysts = highly specific (>90%)
2. T1 hyperintensity in salpinx (hematosalpinx) is a specific finding (if HCG negative)
3. “Solid” (Infiltrative/Deep) variant appears as T2 hypointense nodularity of the affected structure

Endometriosis is theorized to be precursor to which two malignancies?

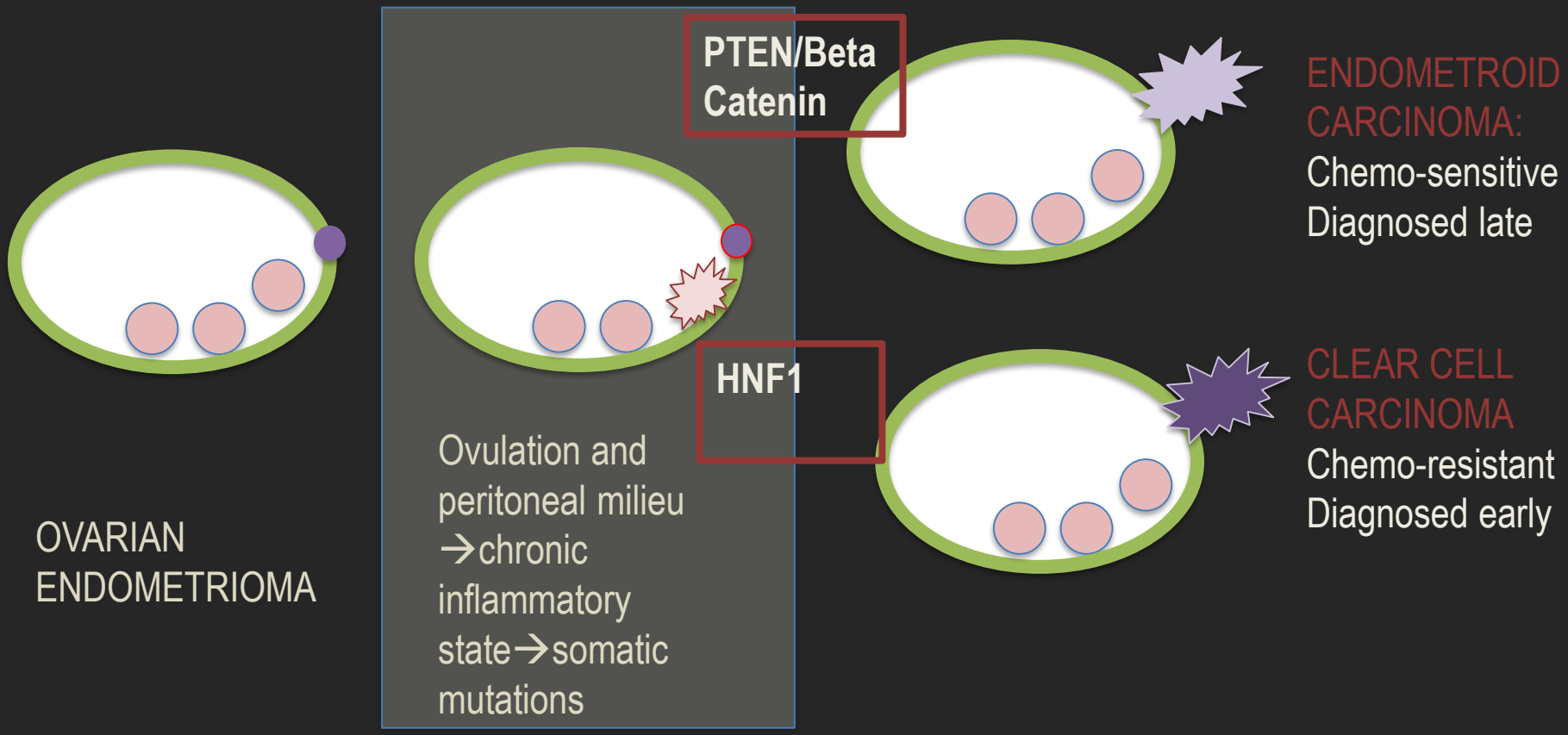
Clear Cell Carcinoma

Endometroid Carcinoma

Exometroid Carcinoma

Cystadenomucinofibrosarcomalignoma

Endometriosis as a Precursor Lesion



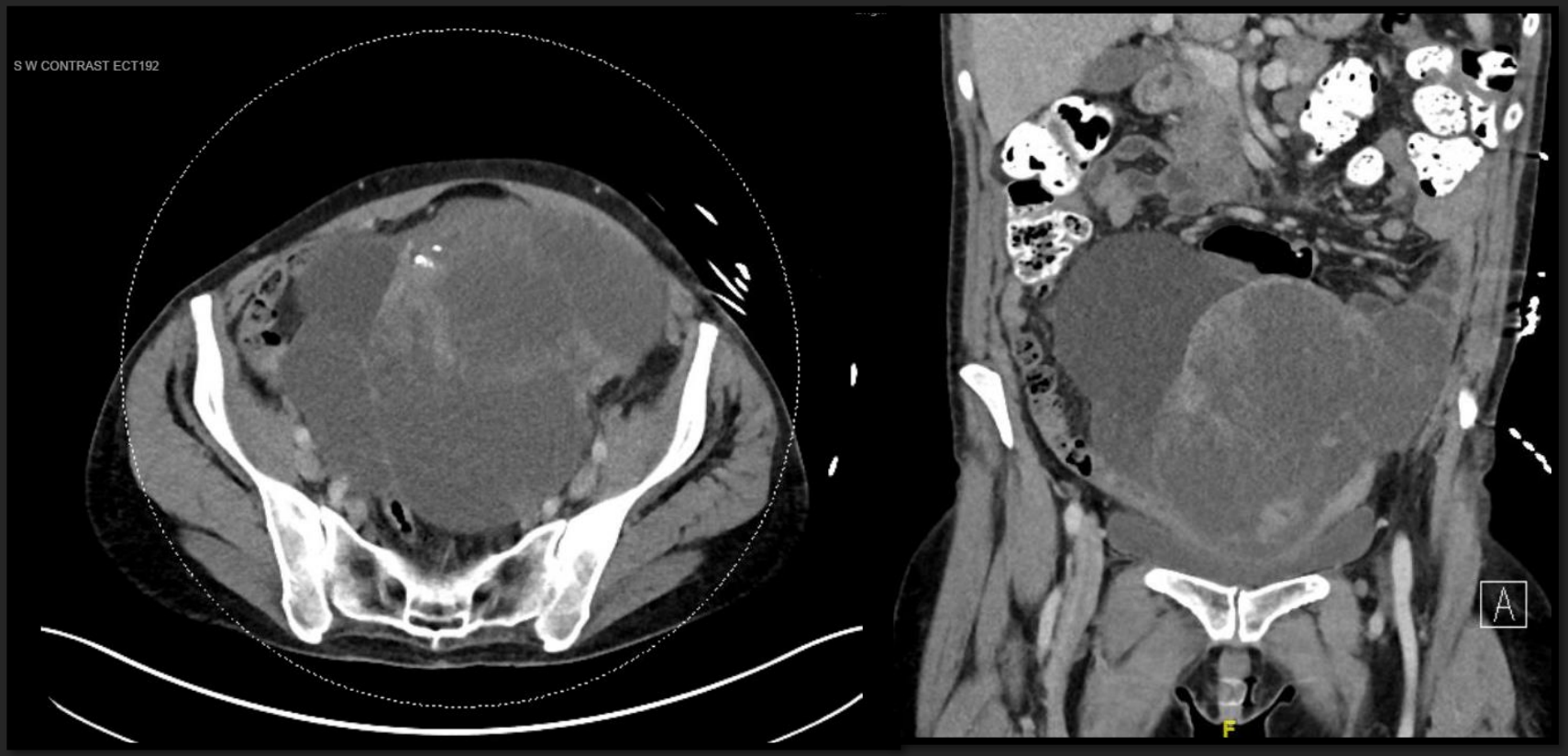
-1-2% of women with endometriosis will develop an endometriosis related malignancy

-Endometroid carcinoma is the 2nd most common OEC

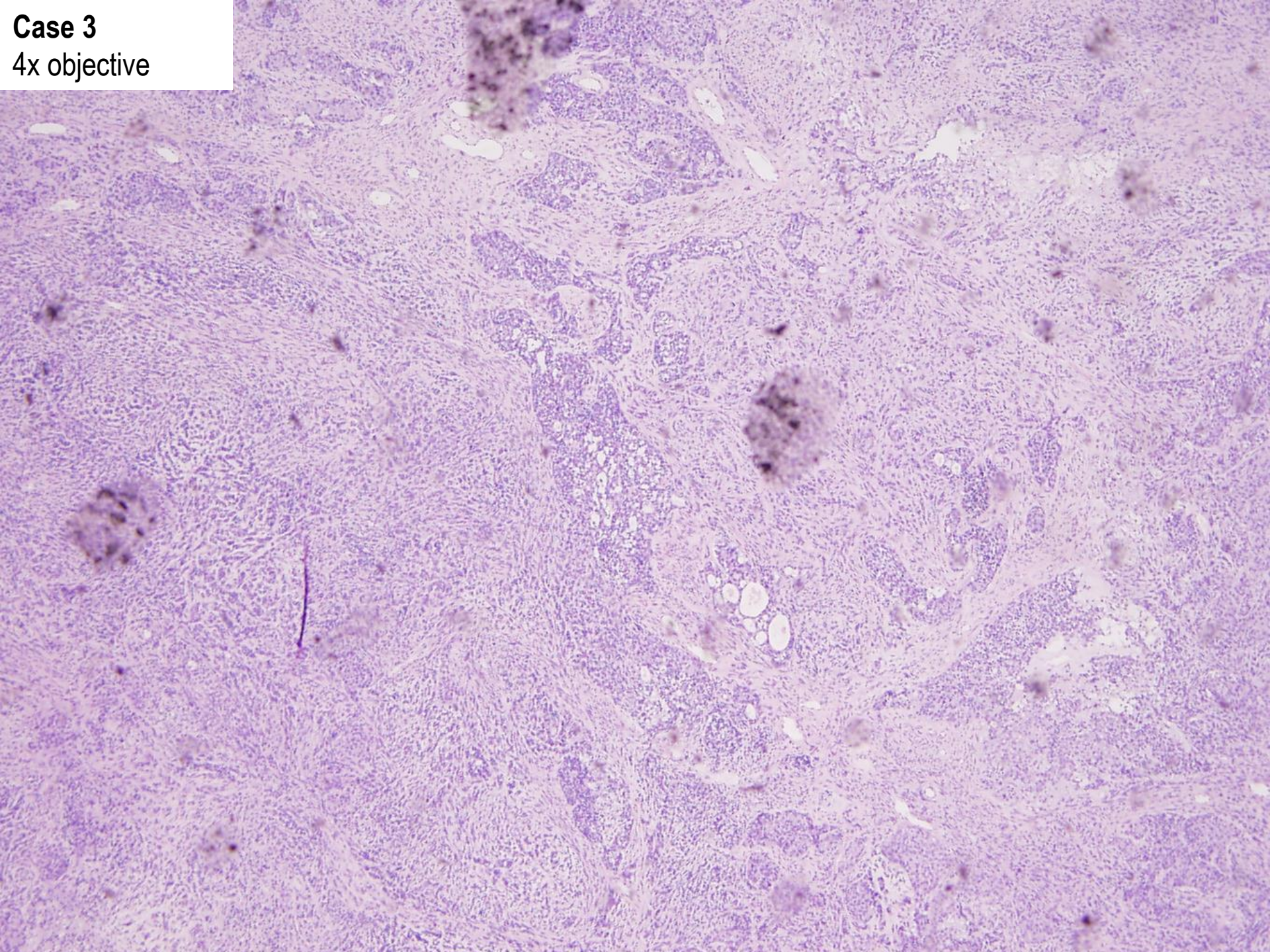
-CCC associated w/ endometriosis in ~50% of cases; Endometroid ~20%

CASE 5

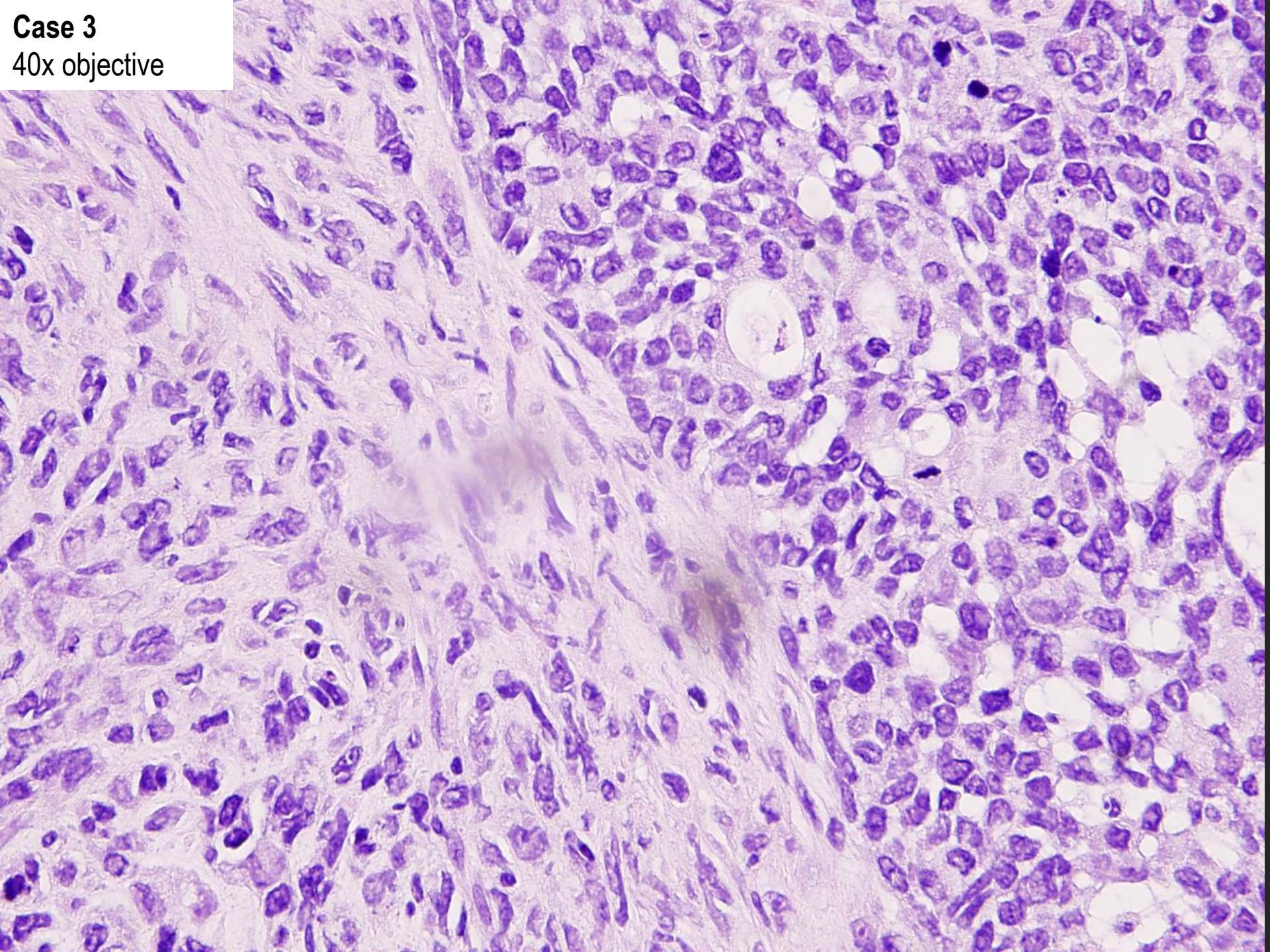
55 year old woman with progressive lower abdominal pain


S W CONTRAST ECT192
A
F

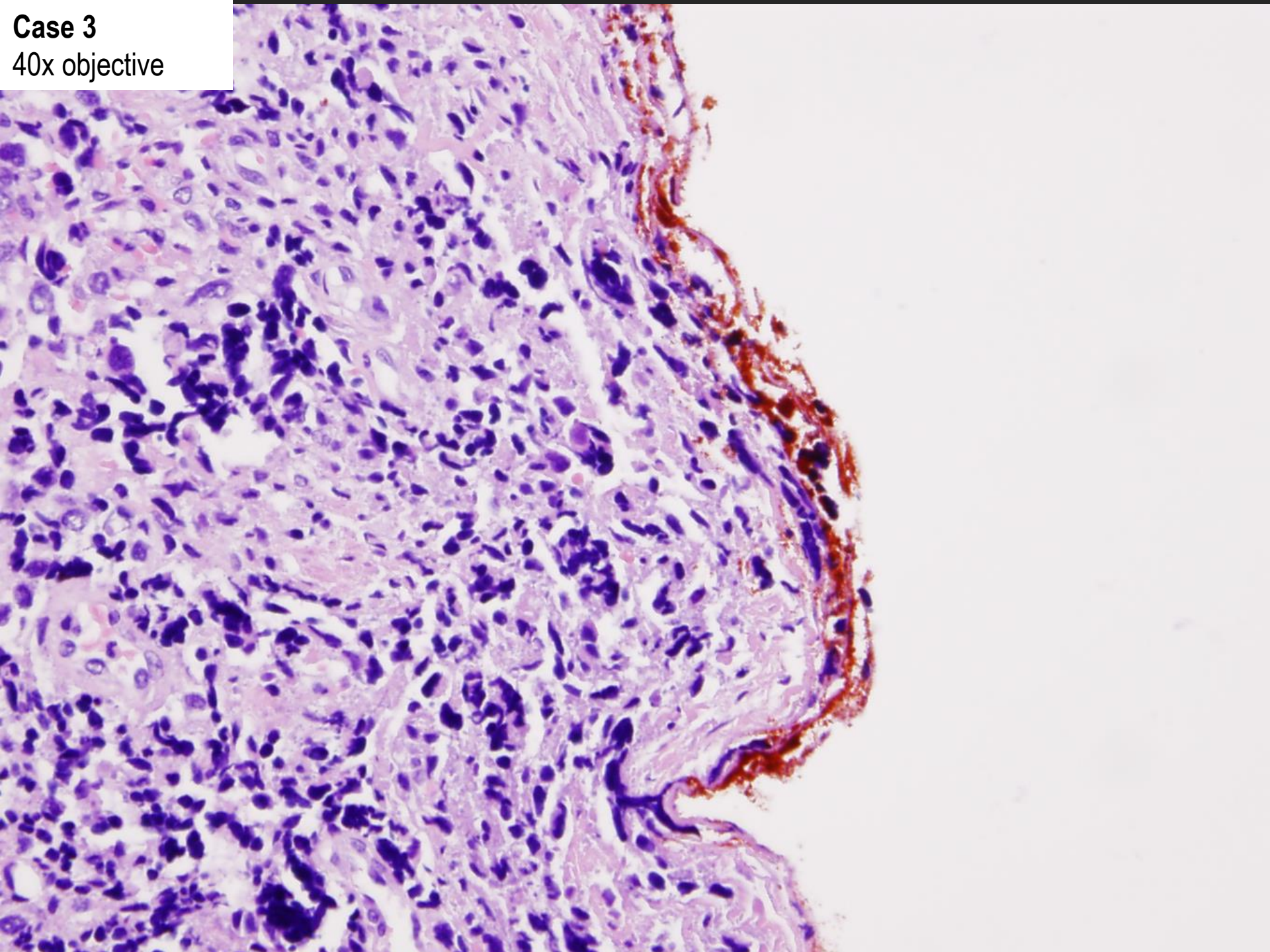
Case 3
4x objective



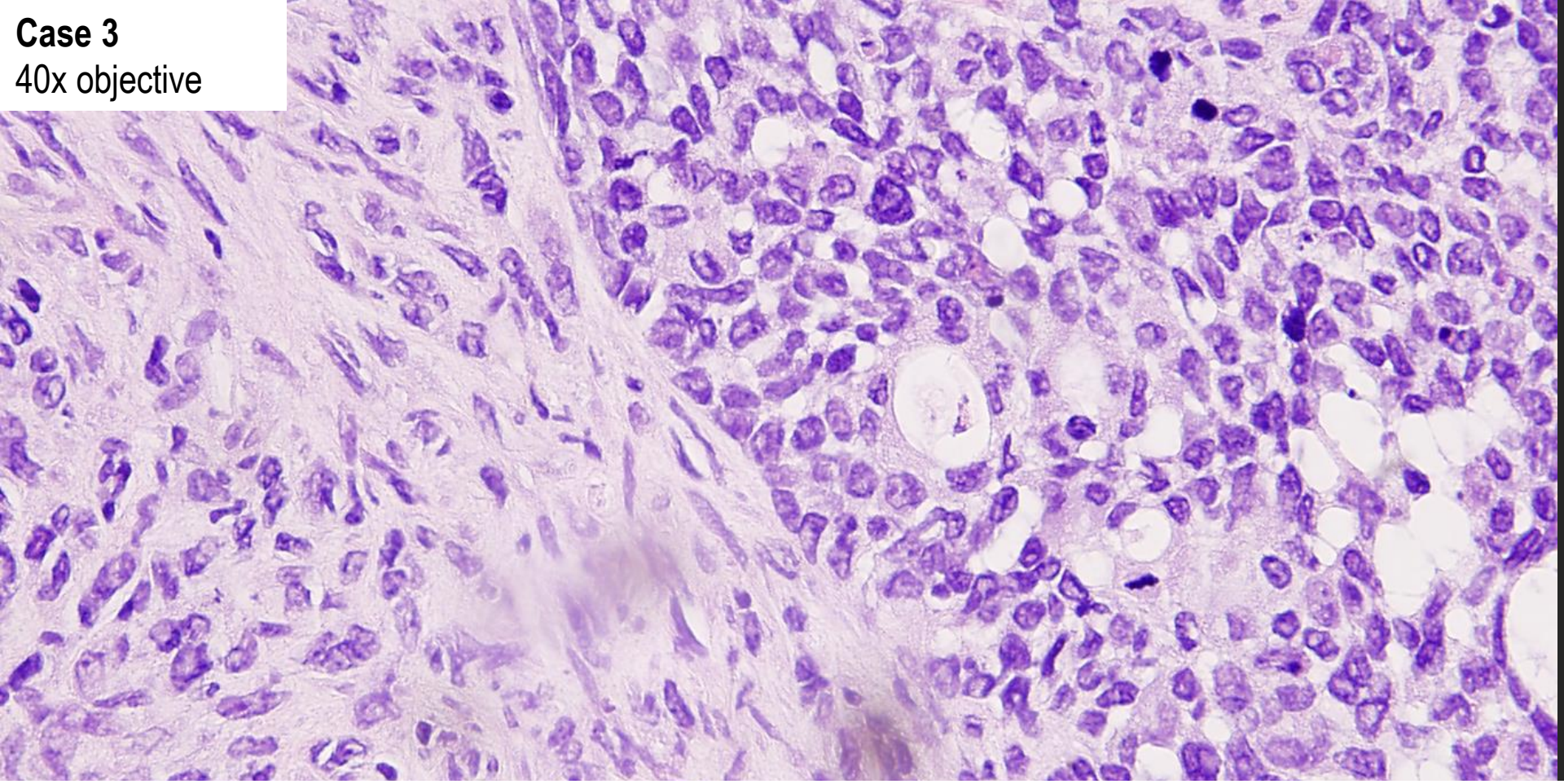
Case 3
40x objective



Case 3
40x objective



Case 3
40x objective



Endomyometrium and serosa:

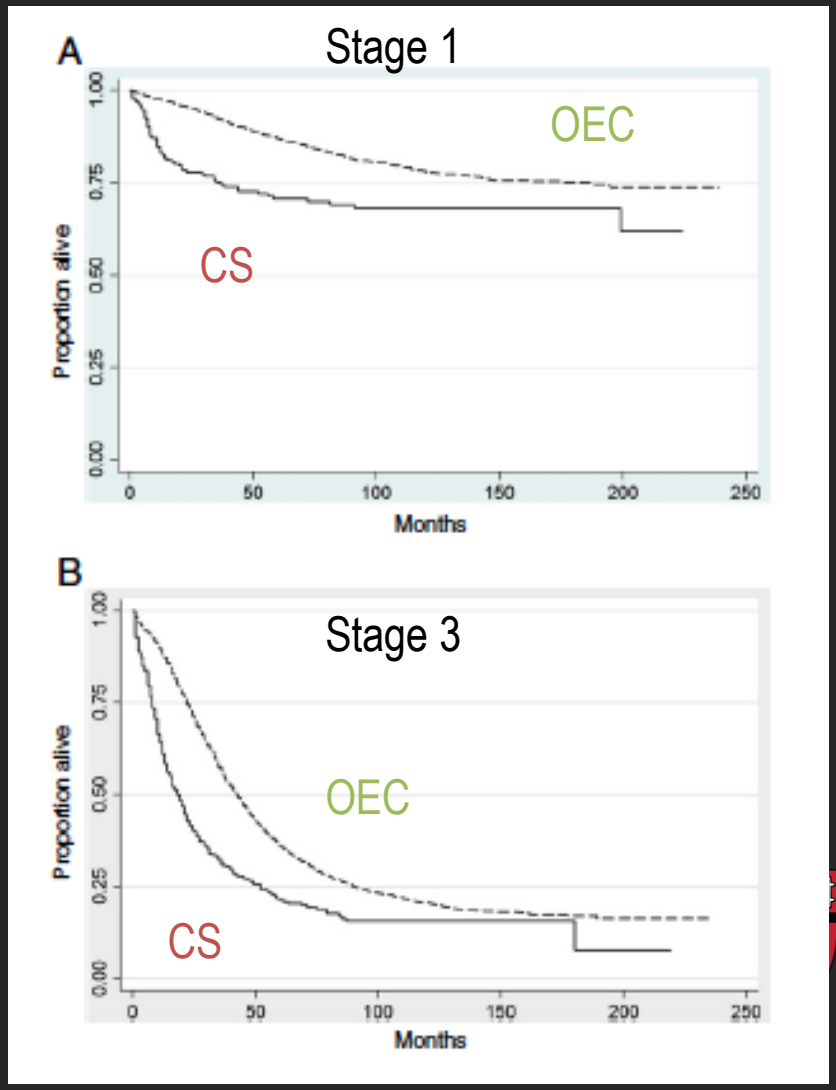
CARCINOSARCOMA, present as two foci (7.0 and 5.0 cm), involving uterine wall and lower uterine segment.

The epithelial component is a high grade Mullerian carcinoma and the sarcomatous component is undifferentiated homologous sarcoma.

Tumor invades through the full thickness of the myometrium and is present at the serosa (slide A7).

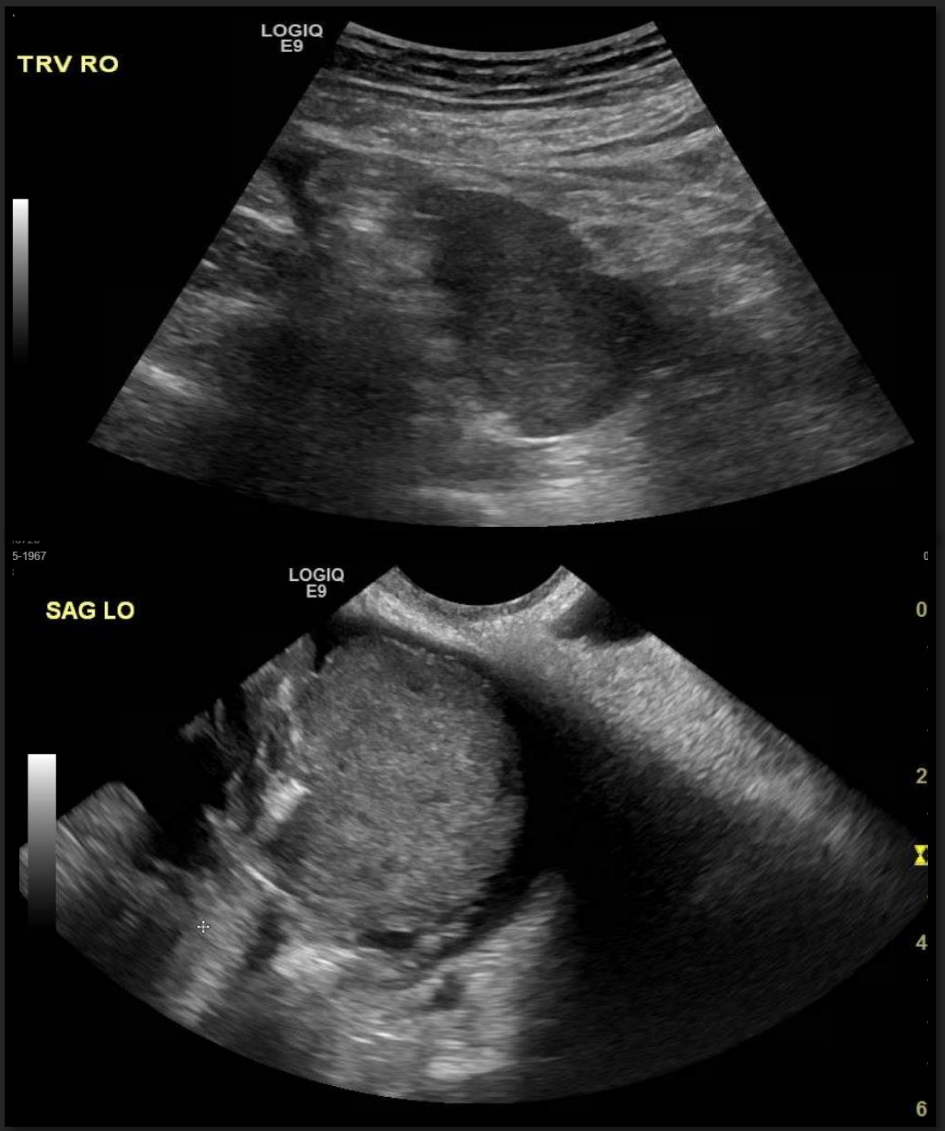
Carcinosarcoma of the Ovary

- 1-4% of all ovarian malignancies
- Contains carcinomatous (epithelial) and sarcomatous (mesenchymal) elements
- Pathogenesis: Collsion v. Combination v. Conversion
- Extremely poor prognosis
- No reliable imaging features to date.



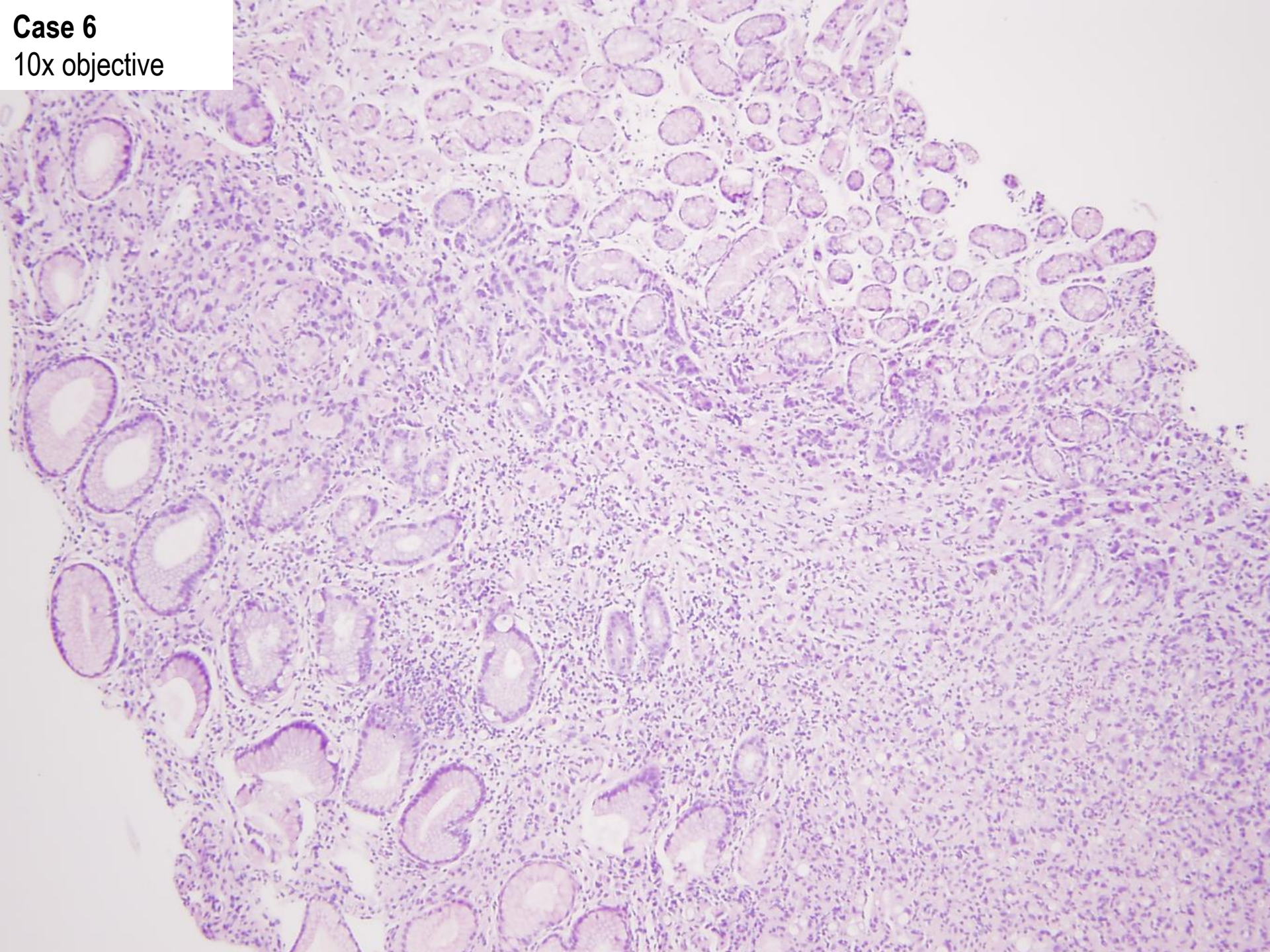
CASE 6

49 year old woman with history of gastric cancer s/p gastrectomy and adjuvant chemotherapy

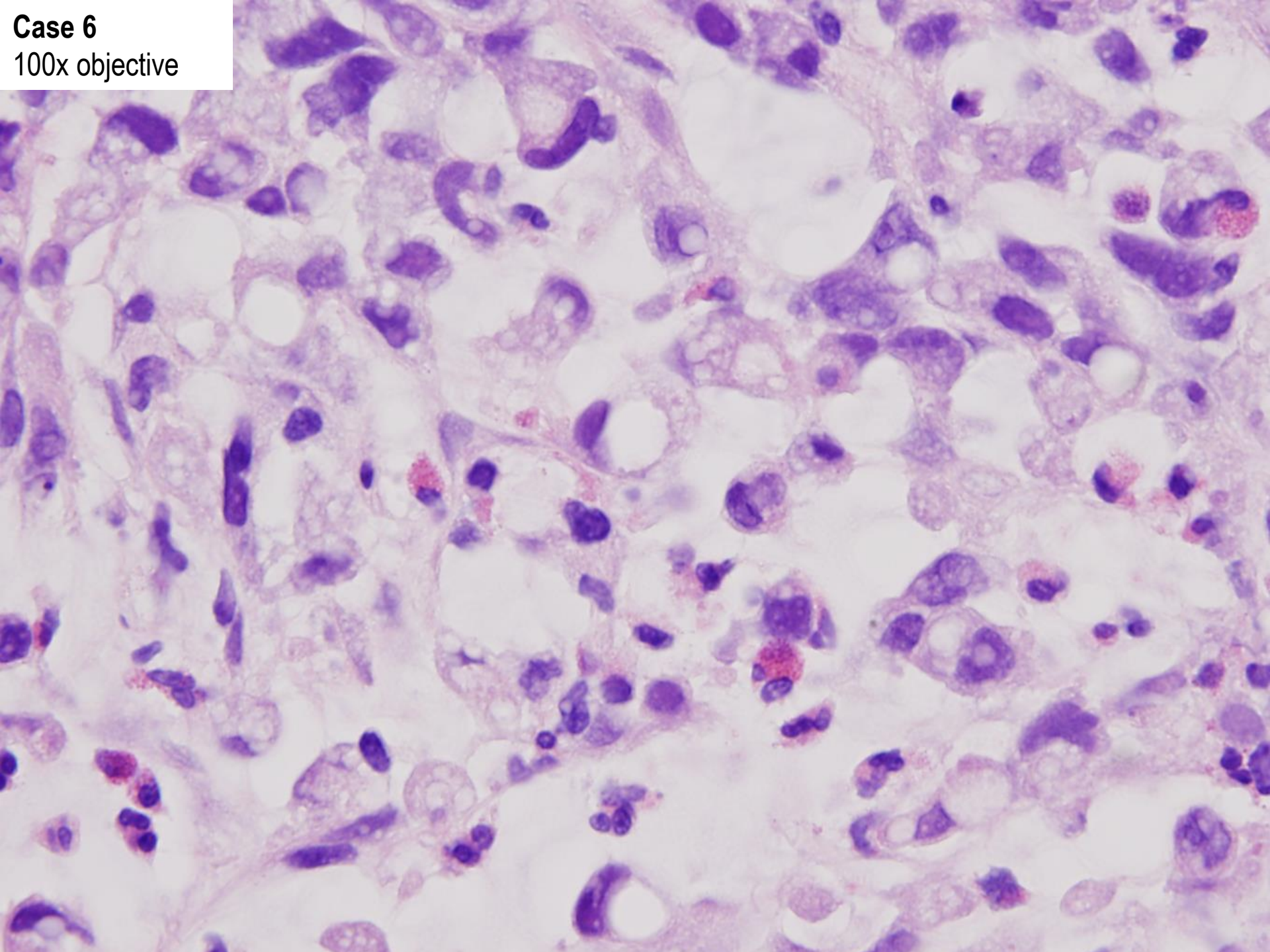

LOGIQ
E9
TRV RO
LOGIQ
E9
SAG LO
0
2
4
6

A

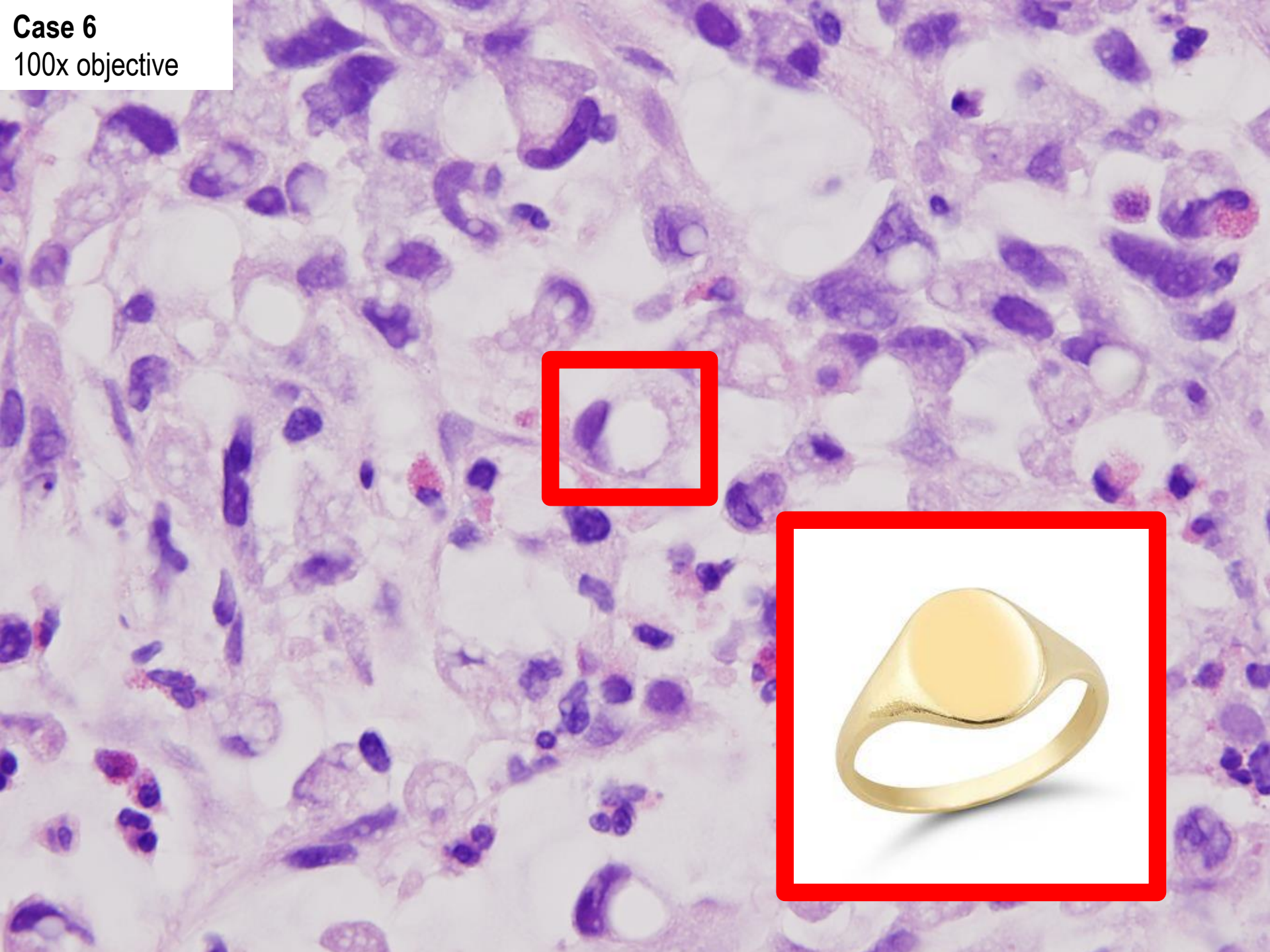
Case 6
10x objective



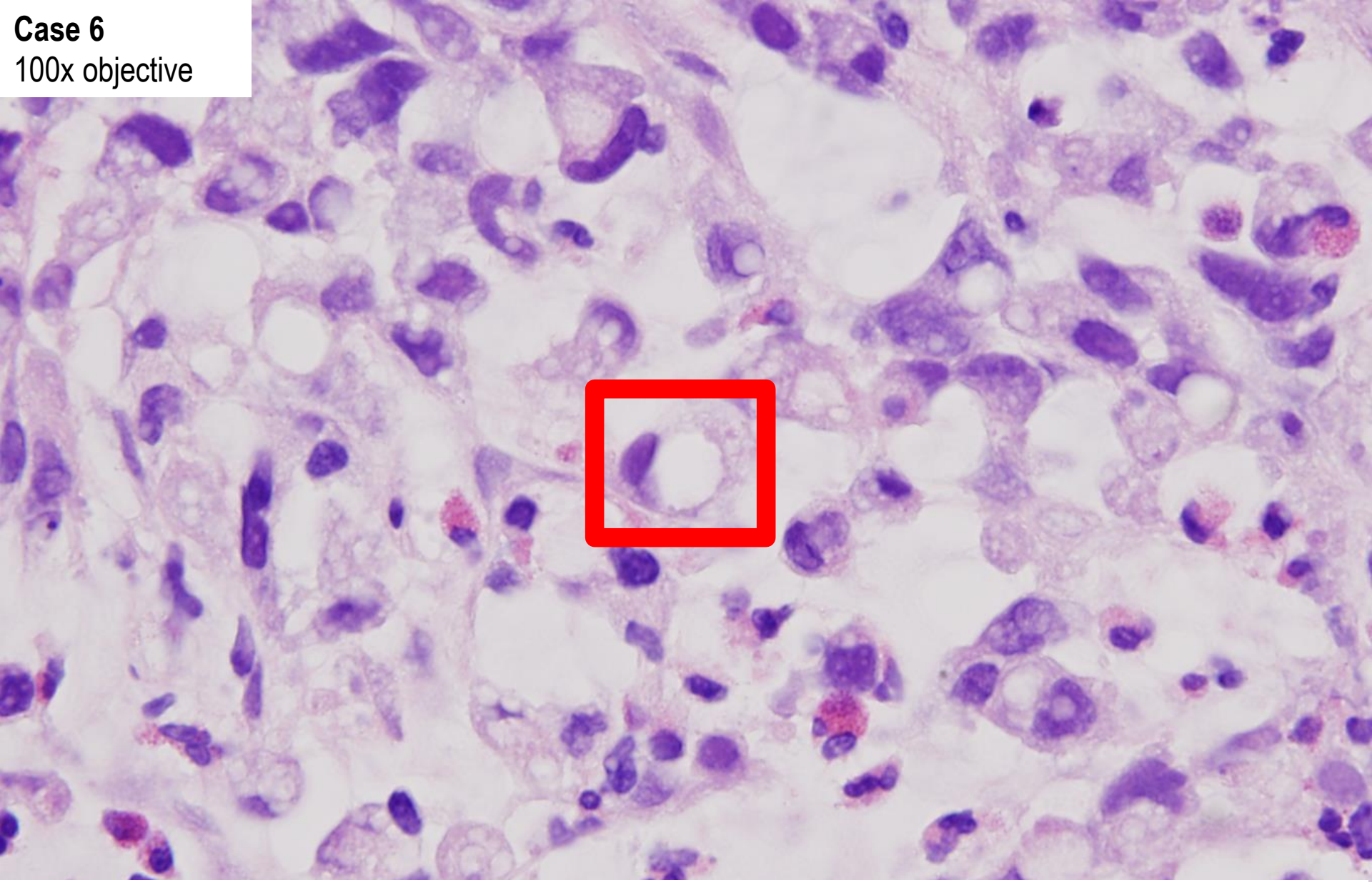
Case 6
100x objective



Case 6
100x objective

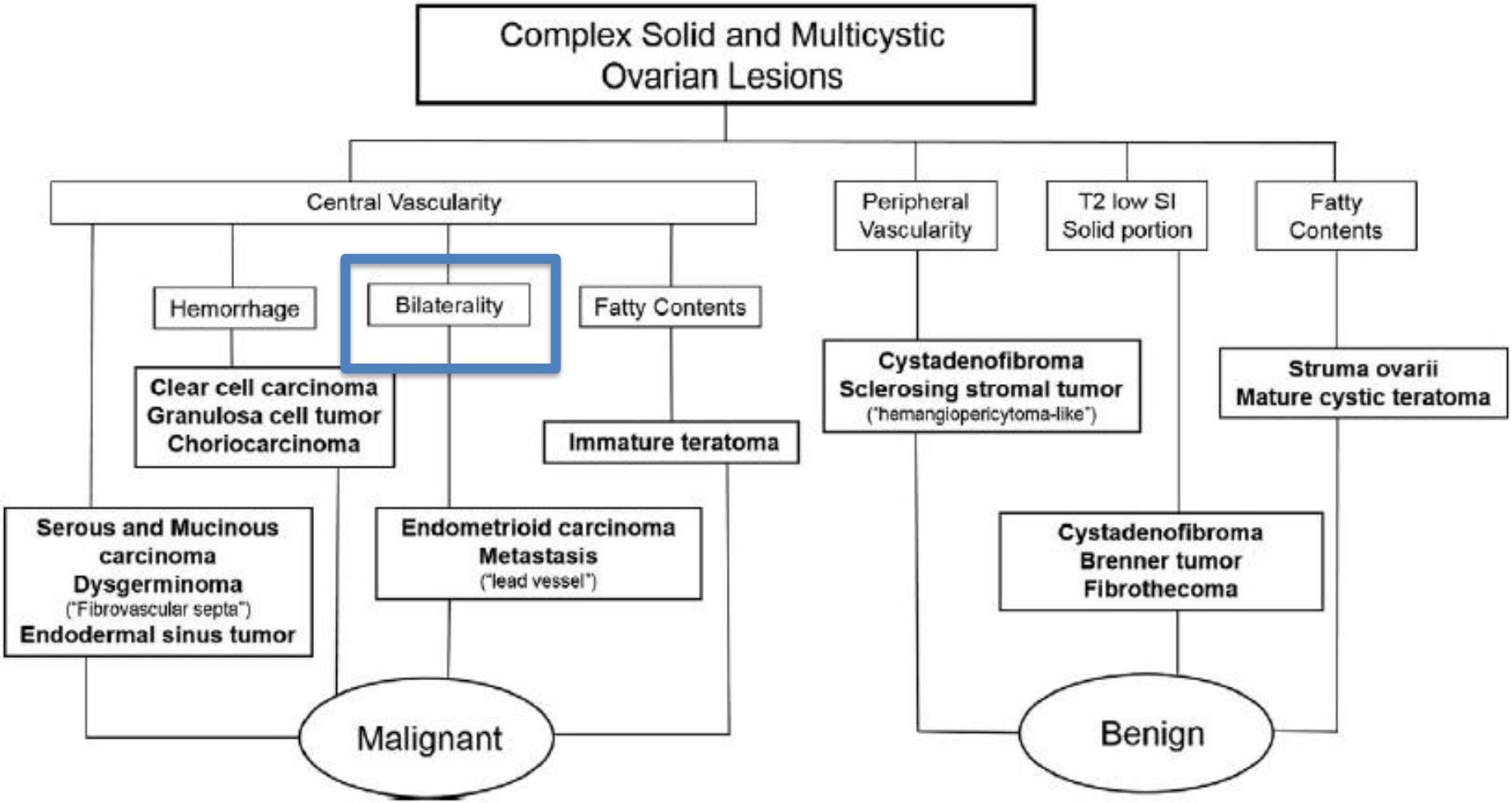


Case 6
100x objective



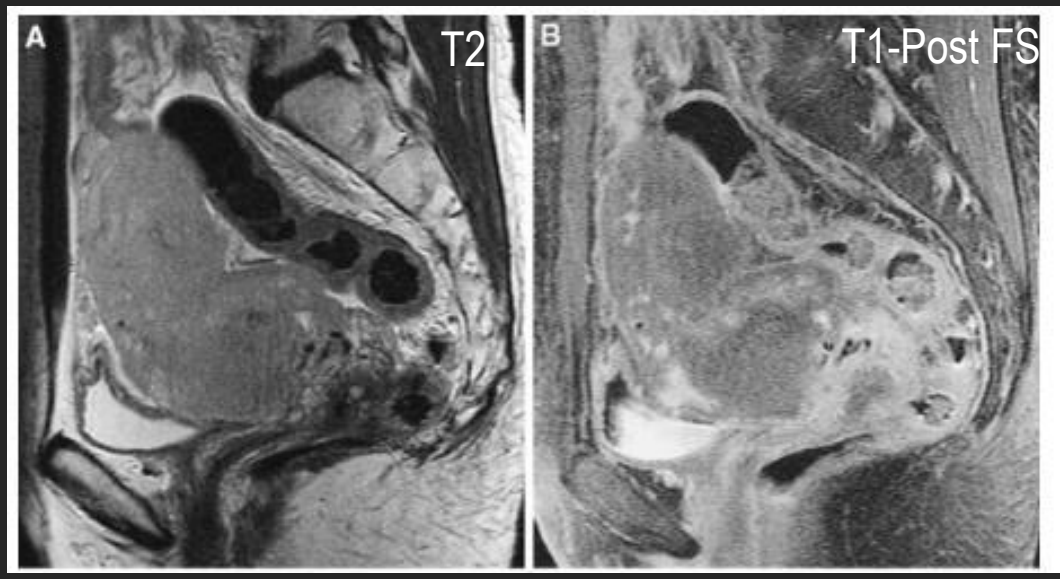
A. GASTRIC BIOPSY:

POORLY DIFFERENTIATED ADENOCARCINOMA WITH SIGNET-RING-CELL FEATURES.


Complex Solid and Multicystic Ovarian Lesions
Central Vascularity
Peripheral Vascularity
T2 low SI Solid portion
Fatty Contents
Hemorrhage
Bilaterality
Fatty Contents
Clear cell carcinoma
Granulosa cell tumor
Choriocarcinoma
Immature teratoma
Cystadenofibroma
Sclerosing stromal tumor
("hemangiopericytoma-like")
Struma ovarii
Mature cystic teratoma
Serous and Mucinous carcinoma
Dysgerminoma
("Fibrovascular septa")
Endodermal sinus tumor
Endometrioid carcinoma
Metastasis
("lead vessel")
Cystadenofibroma
Brenner tumor
Fibrothecoma
Malignant
Benign

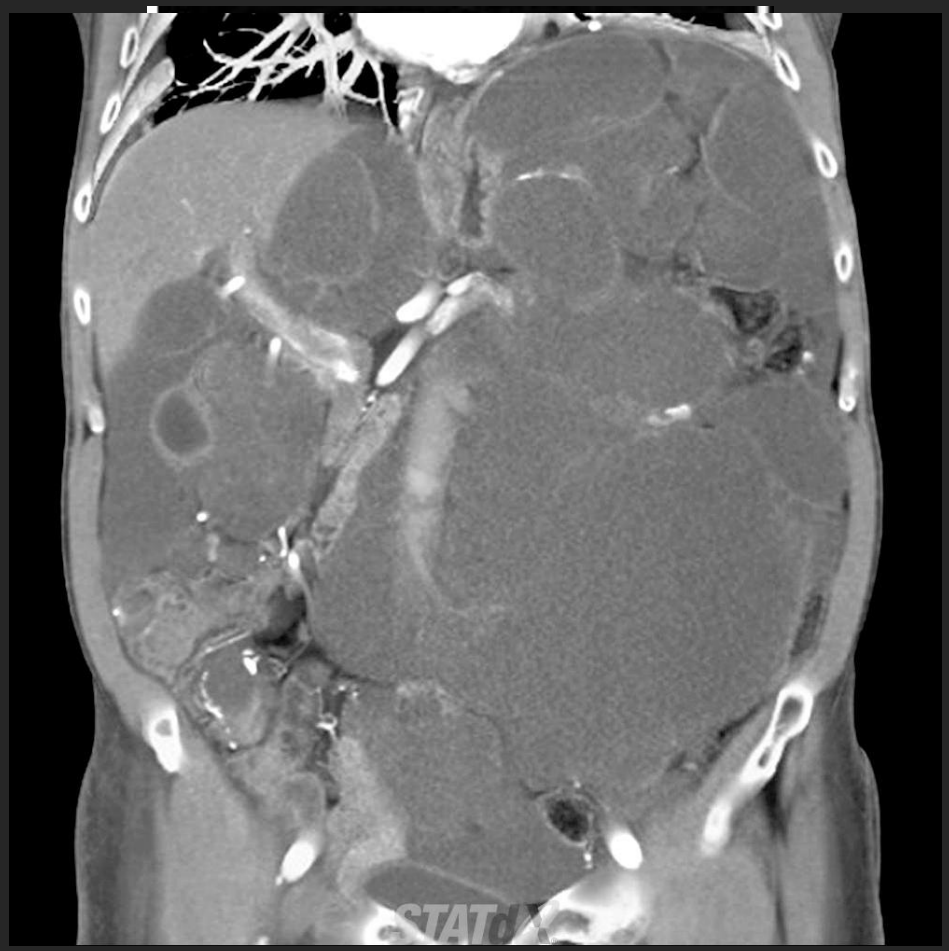
Differential Dx: Bilateral, Solid Ovarian Mass

1. Metastases
2. Primary Ovarian Malignancy
3. Lymphoma



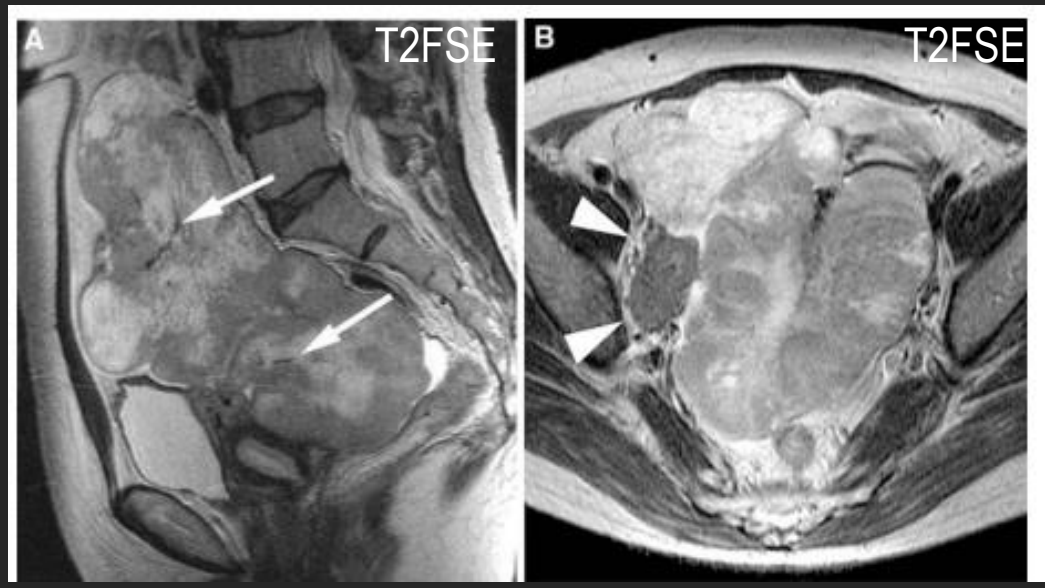
Ovarian Metastases

- 7% of all ovarian solid tumors
- Transperitoneal (“Drop Mets”), hematogenous, and lymphatic origin
- 60-80% bilateral
- Colon is #1 source: “Stained Glass” appearance
- Other flavors:
  - Breast: <5cm
  - Appendiceal: *Pseudomyxoma Peritonei*



True “Krukenberg” Tumors

- “Signet Ring Cell” >10% on pathology
- 76% gastric primary
- Radiographic Features:
  - Solid (Bilateral)
  - Intermediate T1, low or high T2 (cystic and necrotic areas)



Teaching Points

Review Three cell lines comprising ovarian neoplasm
Describe approach to ovarian masses with cross-sectional imaging
Case 1: Mucinous Cystadenoma
- Understand benign vs. borderline & features

Case 2: Cystadenofibroma
- Understand risk of torsion, association with Meigs and Gorlin

Case 3: Ovarian Epithelial Adenocarcinoma
- Understand two theories of pathogenesis
- Review FIGO Staging

Case 4: Endometrioma
- T1 bright spots, hematosalpinx, T2 dark infiltration
- Review common sites and US findings
- Possible precursor lesion for malignancy

Case 5: Carcinosarcoma
- Understand pathology and poor prognosis

Case 6: Krukenberg Tumor
- Understand short ddx for bilateral masses
- “True” Krukenberg definition

Thank you!!

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