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Tips and tricks for diagnosing abdominal soft tissue tumors.

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Learning Objectives:

Soft-tissue tumors

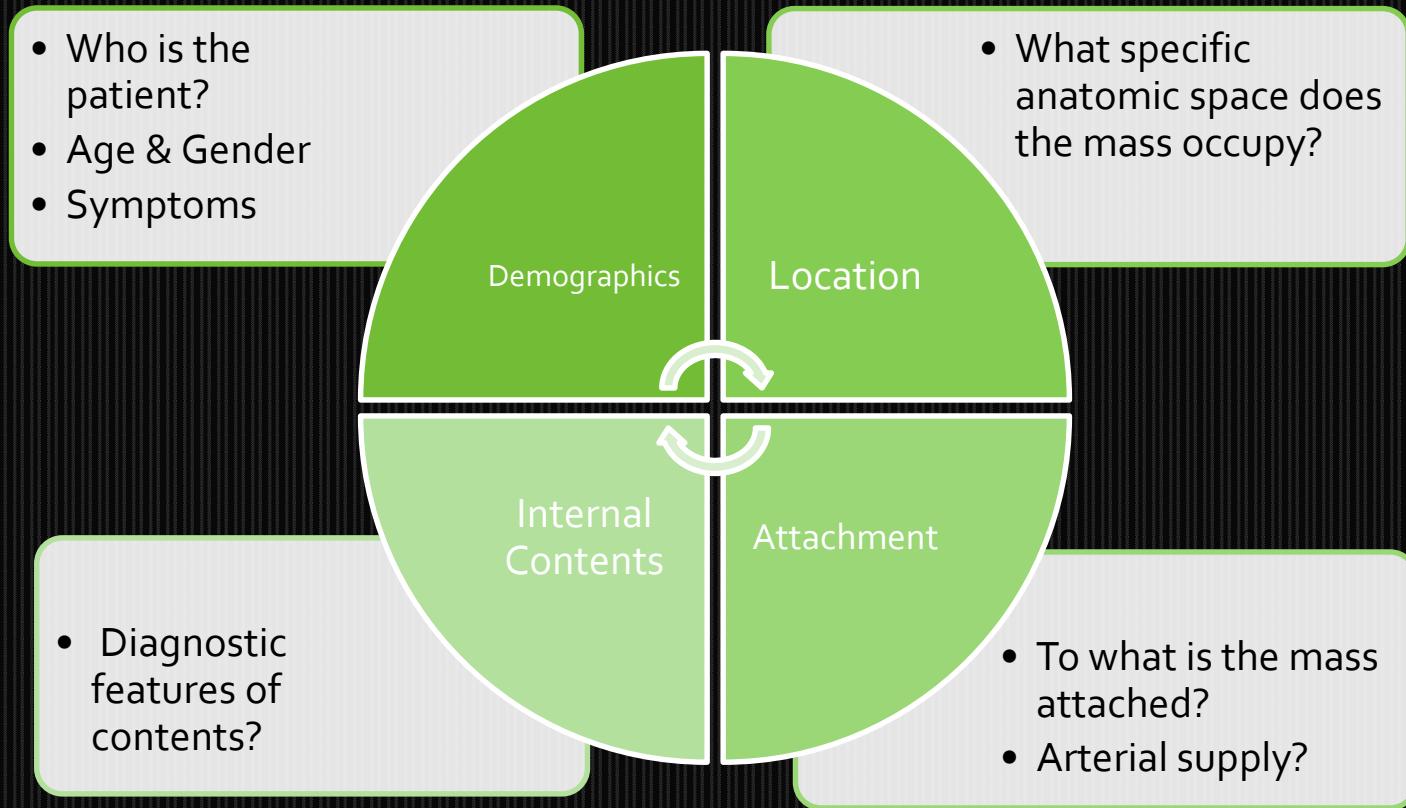
- We will provide an approach to aid
 - Diagnose or narrow the differential diagnosis
 - Direct management (biopsy or surgical approach)
- We will use 5 common abdominal soft-tissue tumors by means of examples
 - Leiomyoma
 - Leiomyosarcoma
 - GIST
 - Nerve-sheath & Neural Origin tumors
 - Liposarcoma

Background:

Role of Imaging in Abdominal Sarcoma

- Location of tumor
 - Organ of origin
- Narrow differential diagnosis
 - Mesenchymal vs Epithelial vs Non-neoplastic
 - Imaging features specific to a diagnosis
- Plan biopsy
 - Route & target
- Plan treatment
 - Local & distant staging
 - Define local extent
 - Treatment planning

Background: The 4 Pillars of Diagnosing Abdominal Soft-tissue Tumors



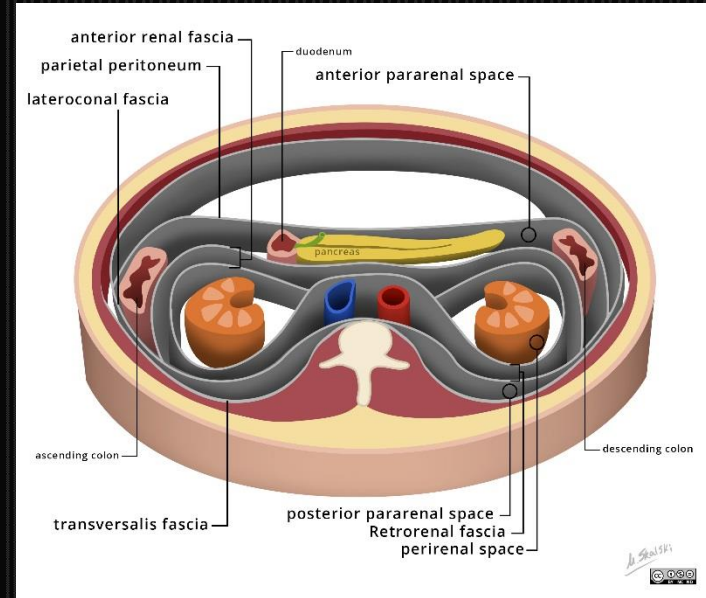
Imaging Findings: LOCATION OF TUMOR

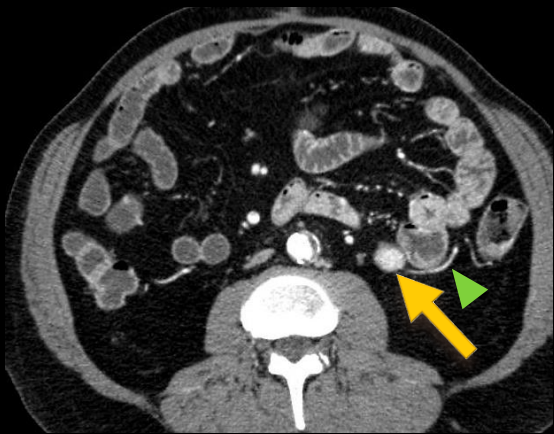
- Intra or retroperitoneal (or both)?
 - A key initial determination in unknown abdo masses
 - This affects surgical planning and even the choice of surgeon

Imaging Findings:

Retroperitoneal spaces

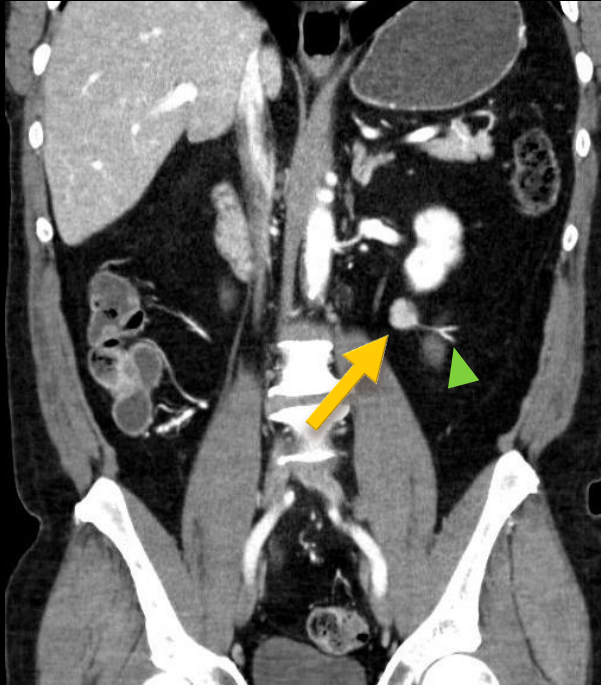
- Knowledge of the multiple spaces is key in determining location and possible extent of masses.
- **Anterior pararenal space** is pertinent in determining **intrapertitoneal vs retroperitoneal** location.
- Anterior pararenal space contains:
 - Ascending & descending colon
 - And their feeding vessels
 - Pancreas and duodenum (D2-4)
 - Continuous with the small bowel mesentery
- These structures are displaced
 - Anteriorly by retroperitoneal masses
 - Posteriorly by intraperitoneal masses



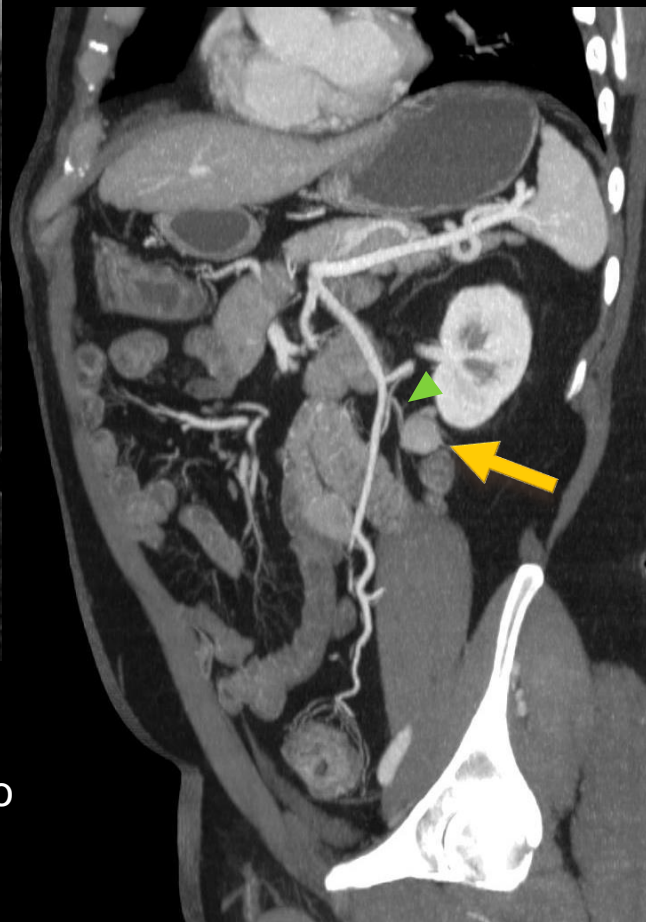


This small tumor (arrow) was called a GIST due to its proximity to jejunum

At surgery no bowel mass was found.



Its vascular pedicle (**left colic vein**, arrowhead) gives clues to its location (**anterior pararenal space, RP**), and its nature (**leiomyosarcoma**)

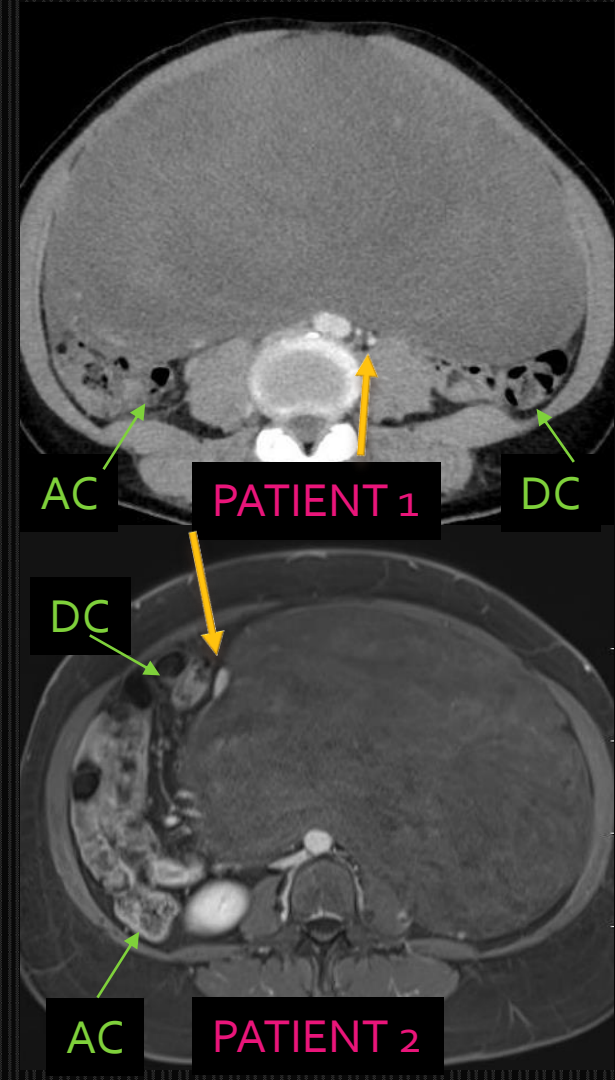


2 PATIENTS WITH PELVIC MASSES EXTENDING INTO THE ABDOMEN.

INTRAPERITONEAL OR RETROPERITONEAL?

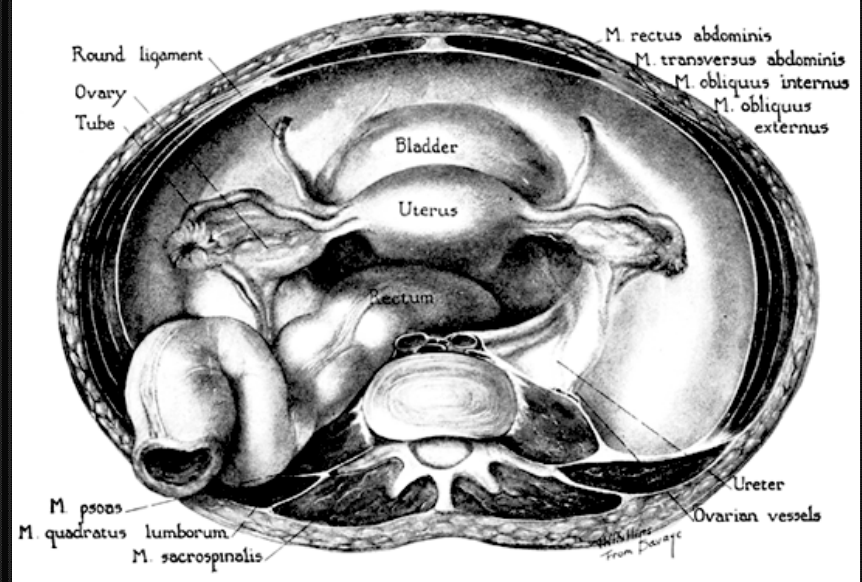
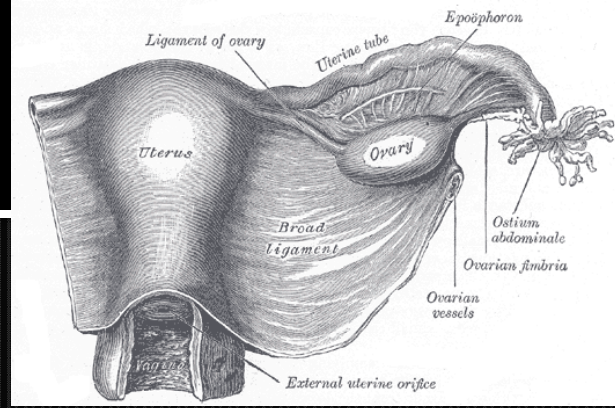
Patient 1: Ascending and Descending colon displaced posteriorly and ovarian vein (yellow arrow) in normal location, therefore **intraperitoneal**

Patient 2: Ovarian vein (yellow arrow) and descending colon displaced anteriorly on left side, therefore **retroperitoneal**



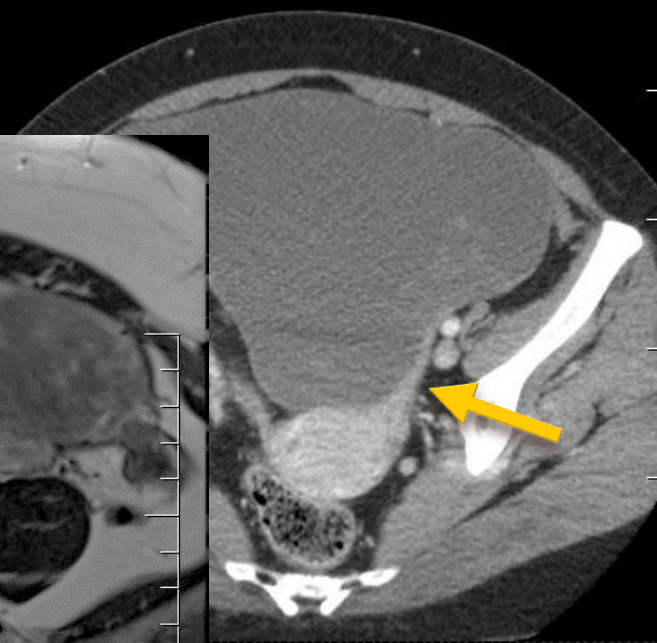
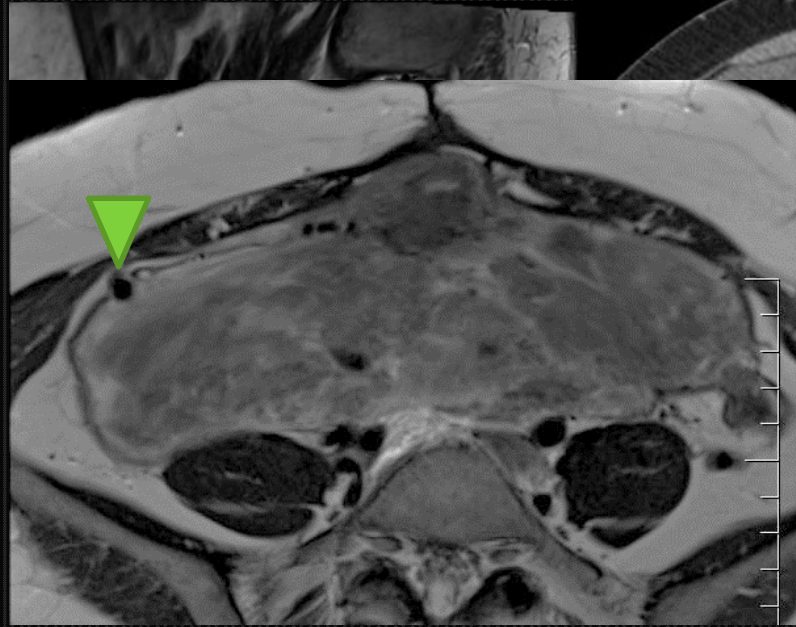
Imaging Findings: Leiomyomas

- Most common site: **Uterus**
 - LOOK CAREFULLY FOR UTERINE ATTACHMENT/SUPPLY
- Parauterine structures 2nd most common site
 - Broad ligament
 - Cervix
 - Round ligament
 - These may be **extraperitoneal** and surprise the surgeon leading to incomplete or no resection.
- Understanding intra vs extraperitoneal anatomy of pelvis is key in directing management.





Cervical Leiomyoma
(arrow cervix)



Round ligament Degenerated
Anterior displacement of
right ovarian vein (arrow round ligament).
(arrowhead) shows that the
mass is extraperitoneal.
Leiomyoma is the most common
tumor of the round ligament.

Procedural Details: Choice of Modalities

- CT, MRI, U/S, Molecular imaging
- Complimentary not competitive
- Relative performance varies
 - Tumor related: Location, size, histology
 - Patient related: Size, renal function, cognition, age, claustrophobia, language barriers, comfort.

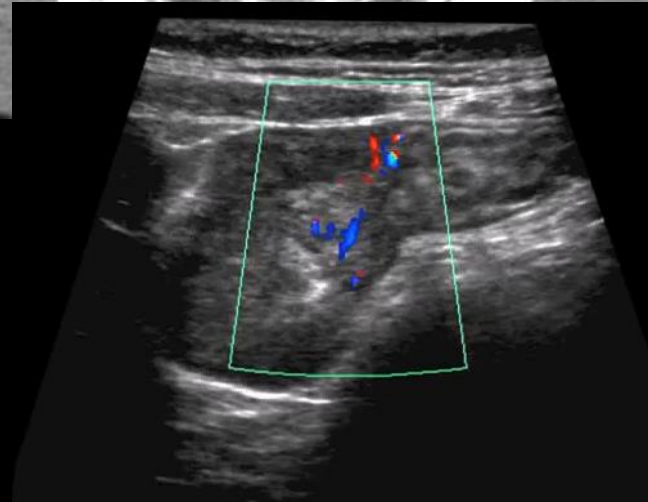
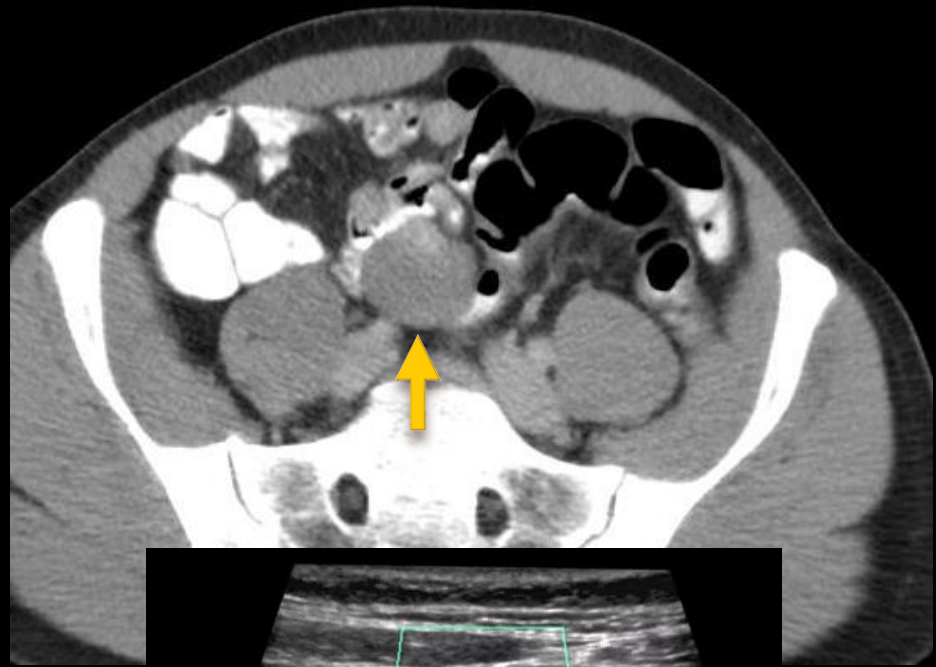
Imaging Findings:

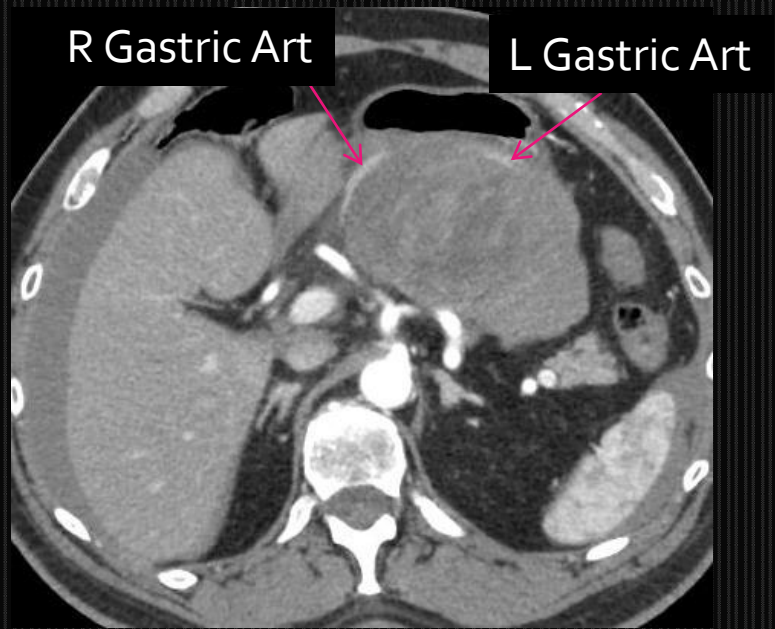
Where is it / What is it coming from?

- Large tumors often in proximity of multiple organs
 - Organ of origin difficult to detect
 - Location/organ of origin often major clue to tumor histology
- Just spend a few minutes looking carefully for
 - Vascular supply/attachment
 - Other pedicles
 - Cannot emphasize enough how often this will lead you to discover detail easily missed!
- Use pedicles to determine origin of tumor
 - Arterial supply: Organ of origin
 - Broad ligament/round ligament: uterine
 - Gonadal vein: Ovarian/Testicular
 - Vas Deferens: Testicular
 - Omental/mesenteric veins: Omental/mesentery
 - Nerves/Intervertebral foramina: Nerve sheath tumors
 - Urachus: Urachal tumors
 - Vitelline artery: Meckels' diverticular tumors

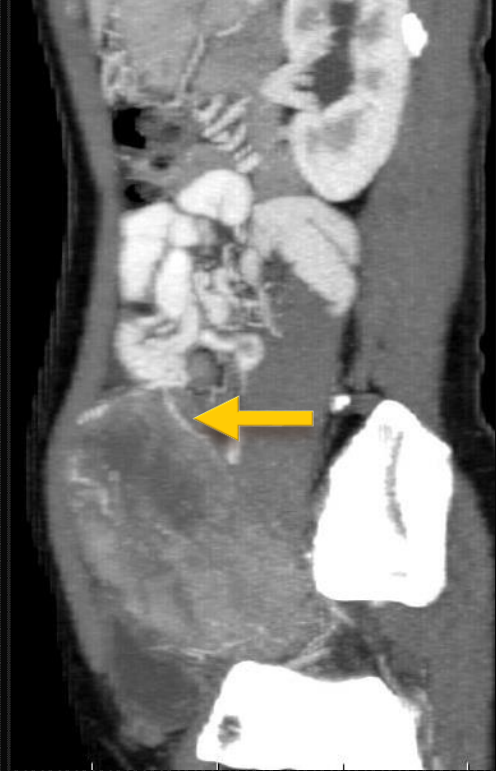
Imaging Findings: GIST tumors

- Recognizing bowel origin of exophytic GISTs may be difficult
- Key to Diagnosing origin: Recognize arterial supply!
- GISTs often have a single visible arterial supply from the organ of origin
- In this case, ultrasound shows arterial supply from ileal loop





Branches of R and L **gastric artery** supplied this tumor and the stomach. No other arterial supply seen. Thus we may confidently call it of gastric origin. Diagnosis: **Gastric GIST**.



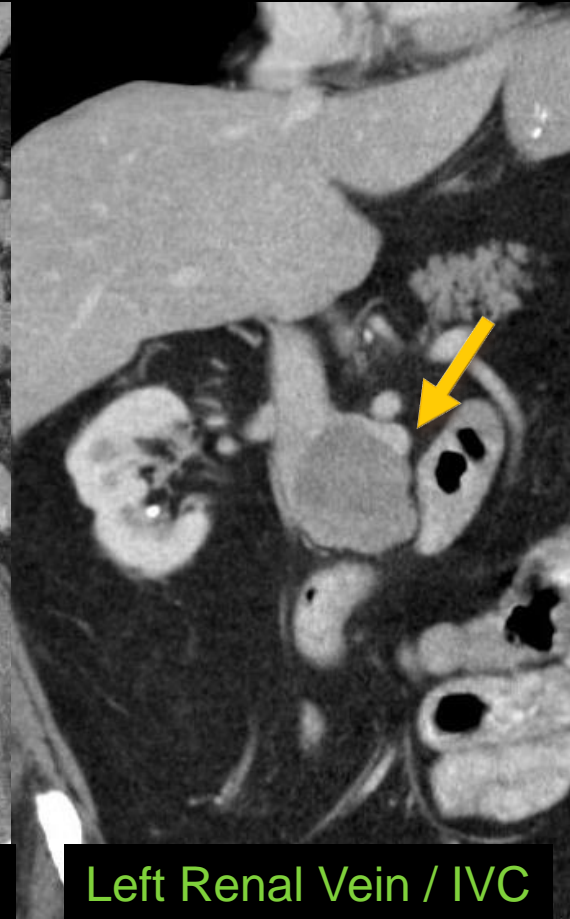
This biopsy proven GIST was called of rectal origin due to their intimacy. Careful evaluation of CT showed arterial supply (arrow) from **small bowel**. Only then did patient agree to surgery.

Imaging Findings: Leiomyosarcoma

- Most common location: Uterus
- Most extrauterine LMS are arising from a vein
 1. IVC
 2. Ovarian veins
 3. Renal veins
- A mass arising from and/or extending into the IVC is most likely a LMS
- LMS is by far most common tumor of veins.
- Key to Diagnosis: Recognize venous origin!

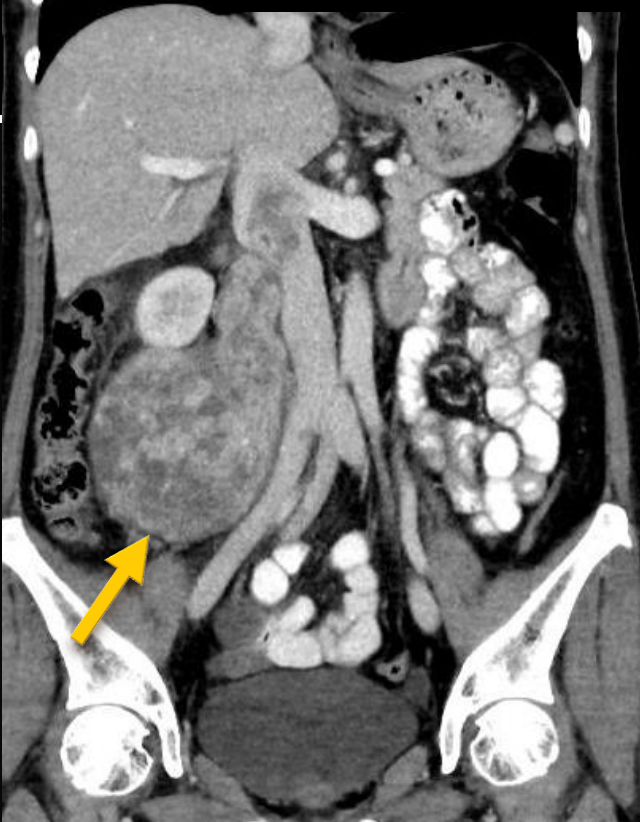


IVC Leiomyosarcoma

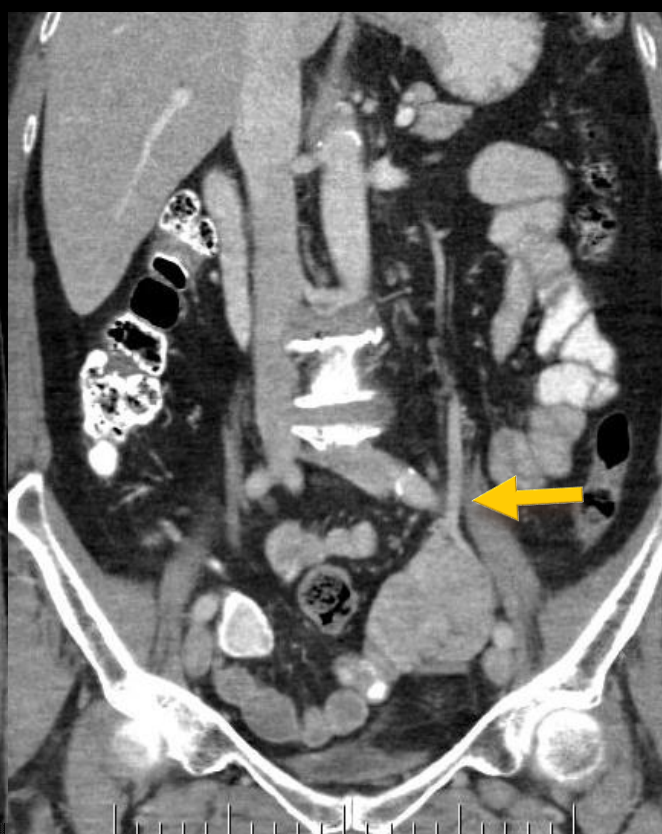


Left Renal Vein / IVC
Leiomyosarcoma

3 cases of Ovarian Vein Leiomyosarcoma



Right gonadal vein



Left gonadal vein

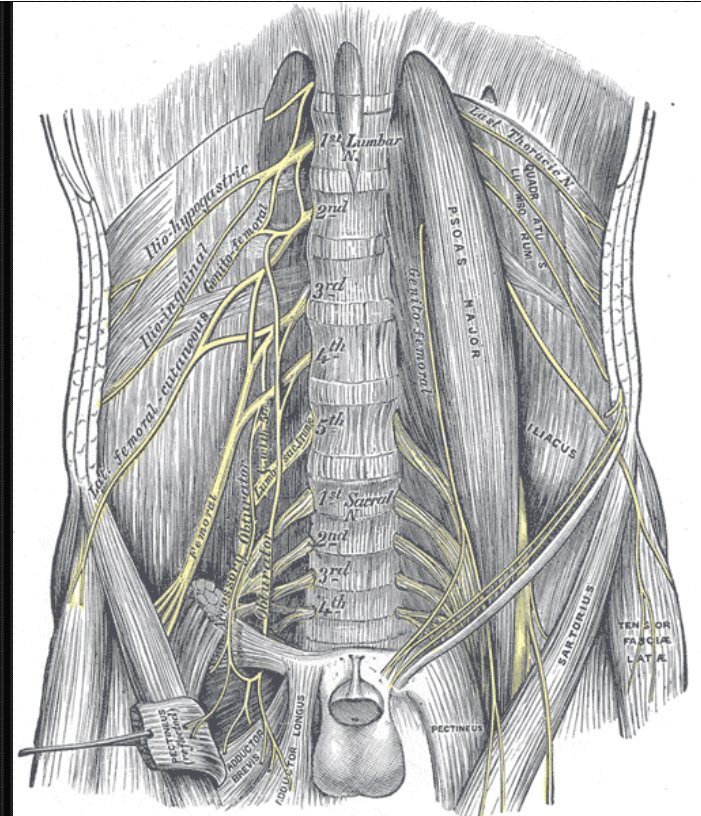


Left gonadal vein

Imaging Findings:

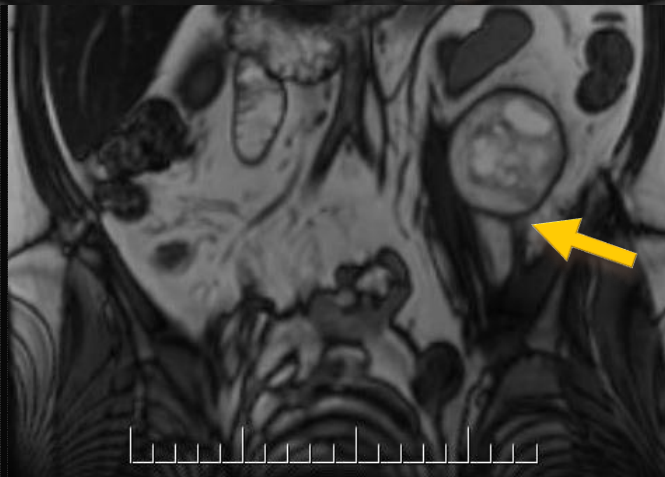
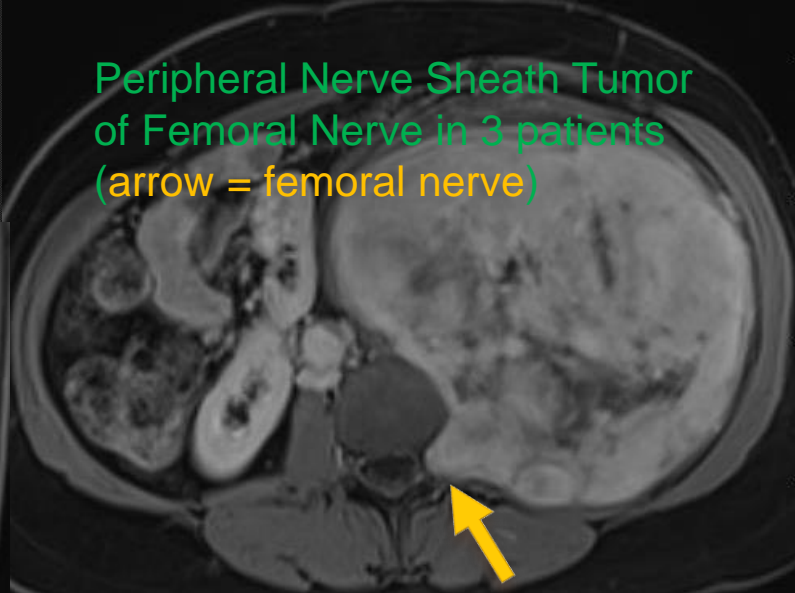
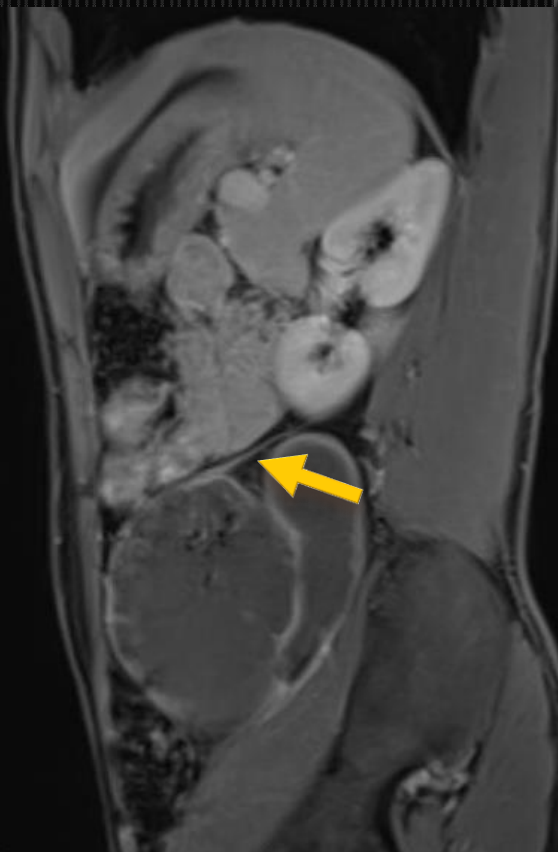
Peripheral Nerve Sheath Tumors

- PNSTs are often arising from major nerve roots/nerves in the trunk
 - PNSTs most commonly affect lumbar/sacral nerve roots
 - Look for extension into/widening of intervertebral foramen
 - Can grow along major nerves
 - Femoral nerve
 - Sciatic nerve
- Note pathway and relationship of major nerves of abdomen.
 - Esp. **femoral nerve** between iliacus and psoas muscles
 - Portions of the femoral nerve are visible in most patients on CT scan.
- **Key to diagnosis:**
 - **Recognition of nerve pedicle is diagnostic!**



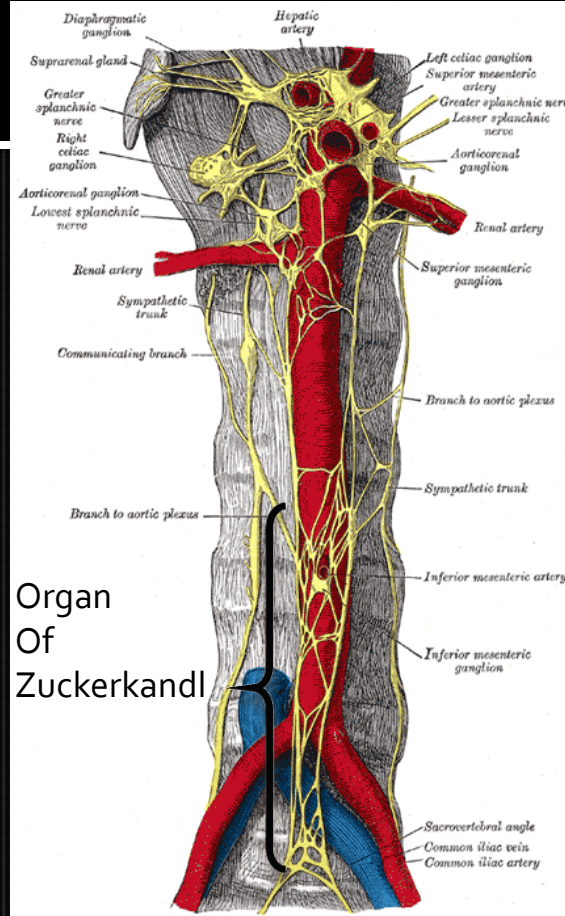
Peripheral Nerve Sheath Tumor

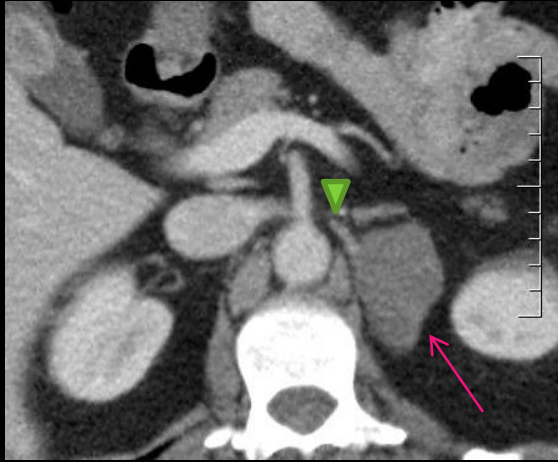
Peripheral Nerve Sheath Tumor
of Femoral Nerve in 3 patients
(arrow = femoral nerve)



Imaging Findings: Sympathetic Plexus

- Sympathetic plexus gives rise to 2 types of tumors in the abdomen
 - Paragangliomas
 - Neuroblastoma/ganglioneuroma
- Celiac ganglia can be seen in most patients:
 - Adjacent to diaphragmatic crus
 - Medial to adrenal glands
 - Posteromedial to IVC (right celiac G).
- Knowing sympathetic plexus anatomy may help diagnosis above tumors





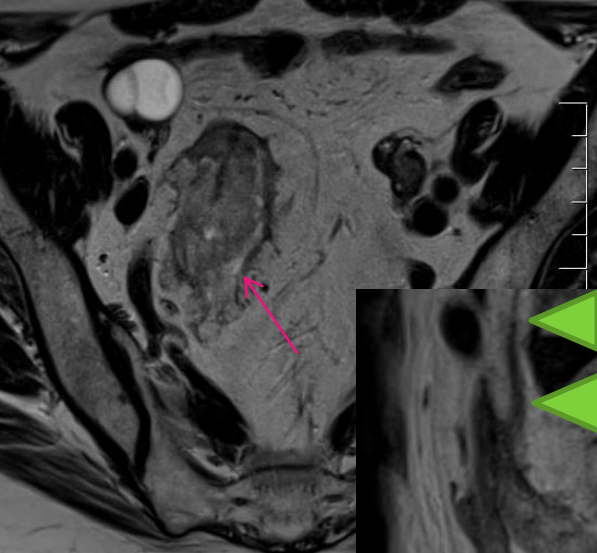
54 Y Male, Incidental
hypovascular mass
(pink arrow)



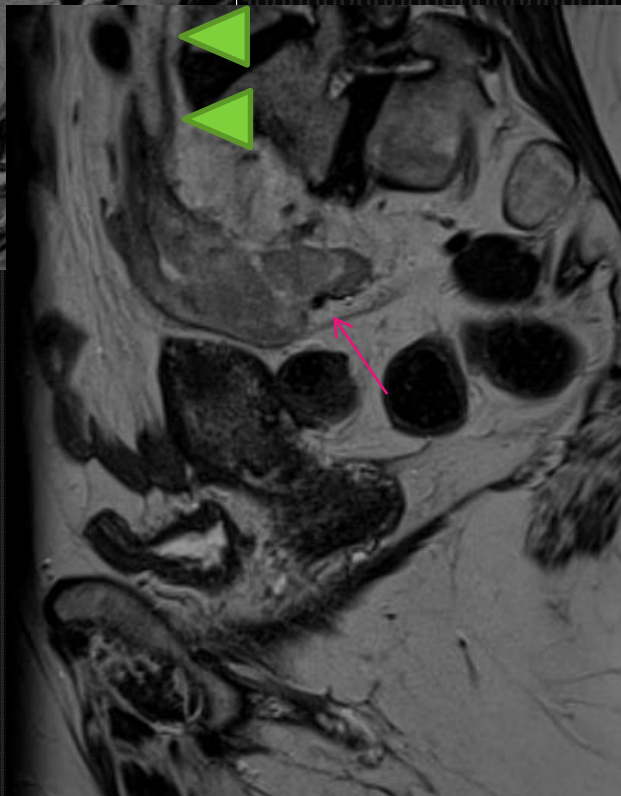
Tumor arises from
Left celiac ganglion
(arrowhead)



Diagnosis:
Ganglioneuroma



Diagnosis:
Ganglioneuroma



2 patients
Incidental
mass
(pink arrow)



Note
attachment to
sympathetic
trunk
(arrowheads)

Imaging Findings: Specific Features

- Water
 - Lymphangiomas, Cysts
- Chyle
 - Water with microscopic fat (MRI opposed phase T₁)
 - Lymphangiomas, chylous collections
- Gross fat (CT detectible)
 - See next slides
- Microscopic fat
 - + helpful in some renal/adrenal masses
 - Ovarian thecomas
 - Chyle
- Myxoid
 - Very high T₂ SI with some solid or enhancing components
 - Myxoid leiomyoma, Angiomyxoma
- Fibrous tissue
 - Fibromatosis
 - Retroperitoneal fibrosis/IgG-4
 - Ovarian fibromas
- Ossification
 - Osteosarcoma
- Calcification
 - Utility depends on tumor & location
- Blood
 - Endometriosis
 - Hemorrhagic tumors, esp GIST

Imaging Findings:

Specific Features: Fat

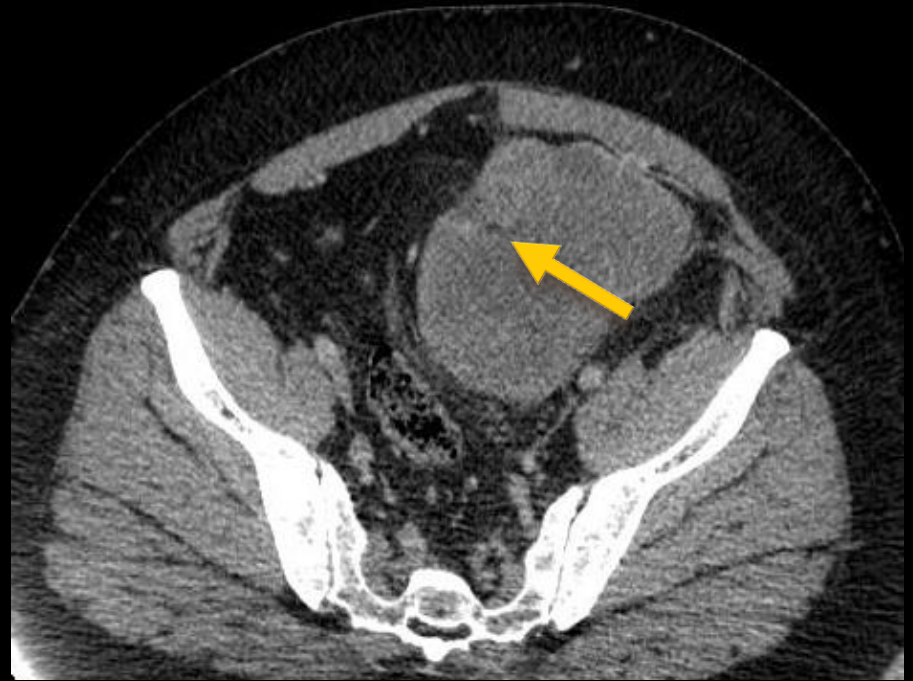
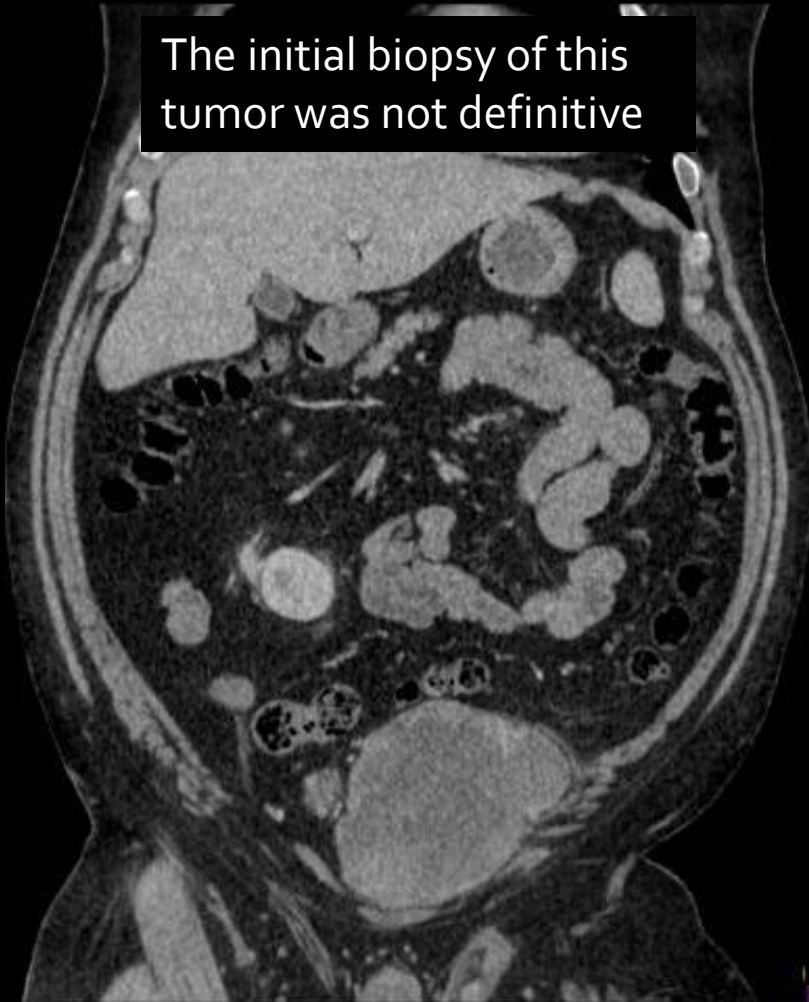
- Lipomatous tumors are one of the most common soft-tissue tumors in the abdomen and pelvis.
- Gross fat is very helpful in diagnosing lipoma/liposarcomas.
- Sometimes the fatty component is quite small.
 - Unknown mass should be carefully interrogated for fat.
- But not every fatty retroperitoneal fat is a liposarcoma...
- Other masses with gross fat:
 - Angiomyolipomas
 - Renal or extra-renal
 - Myelolipomas
 - Adrenal or extra-adrenal
 - Extramedullary Hematopoiesis
 - Esp. paraspinal or presacral
 - Ganglioneuroma
 - Germ-cell tumors
 - Undescended testes or presacral
 - Leiomyomas
 - Uterine or para-uterine



Dedifferentiated Liposarcoma

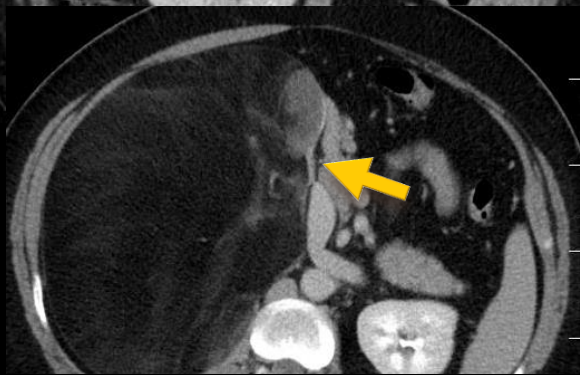
Gross fat is very helpful
in diagnosing
lipoma/liposarcomas

The initial biopsy of this tumor was not definitive



The discovery and biopsy of the fatty element (arrow) allowed a firm diagnosis:
Minimal Fat Liposarcoma

Carefully assess every indeterminate mass for fat!

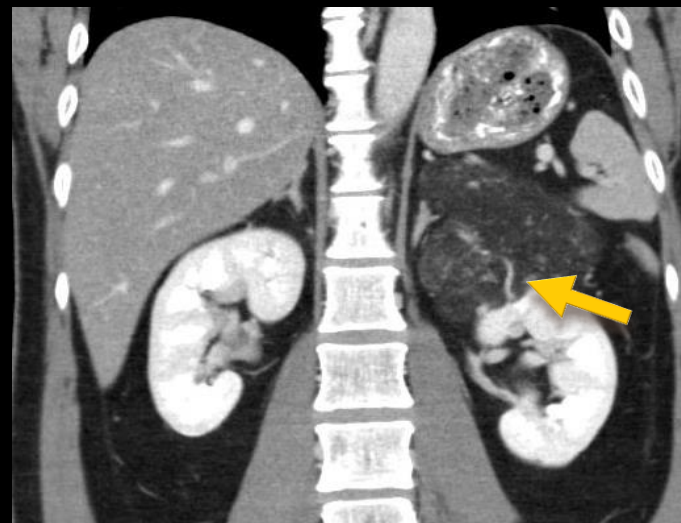


Adrenal Myelolipoma
(arrow adrenal gland/ vein)

Careful
interrogation of
fatty masses for
draining veins is
important in
determining the
origin and
nature of fatty
tumors...

Can you see
the vascular
supply for these
masses?

(click for
answer)

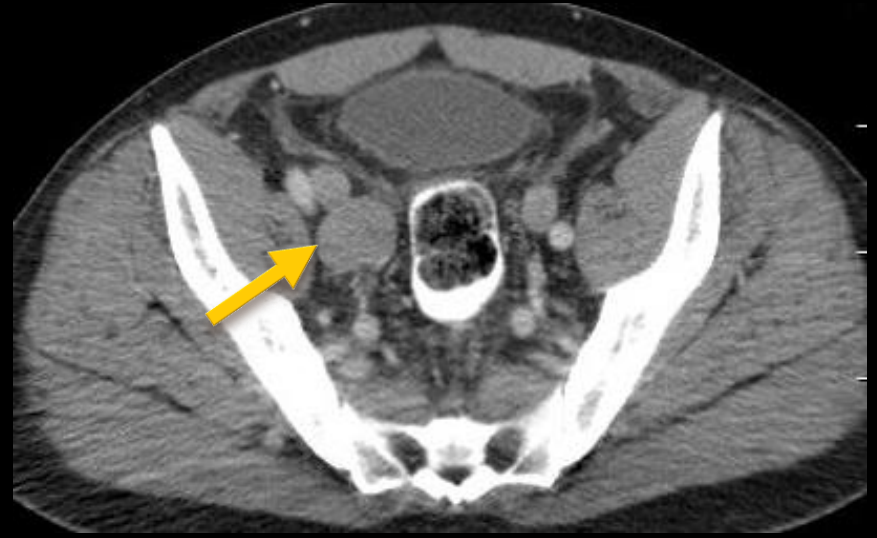
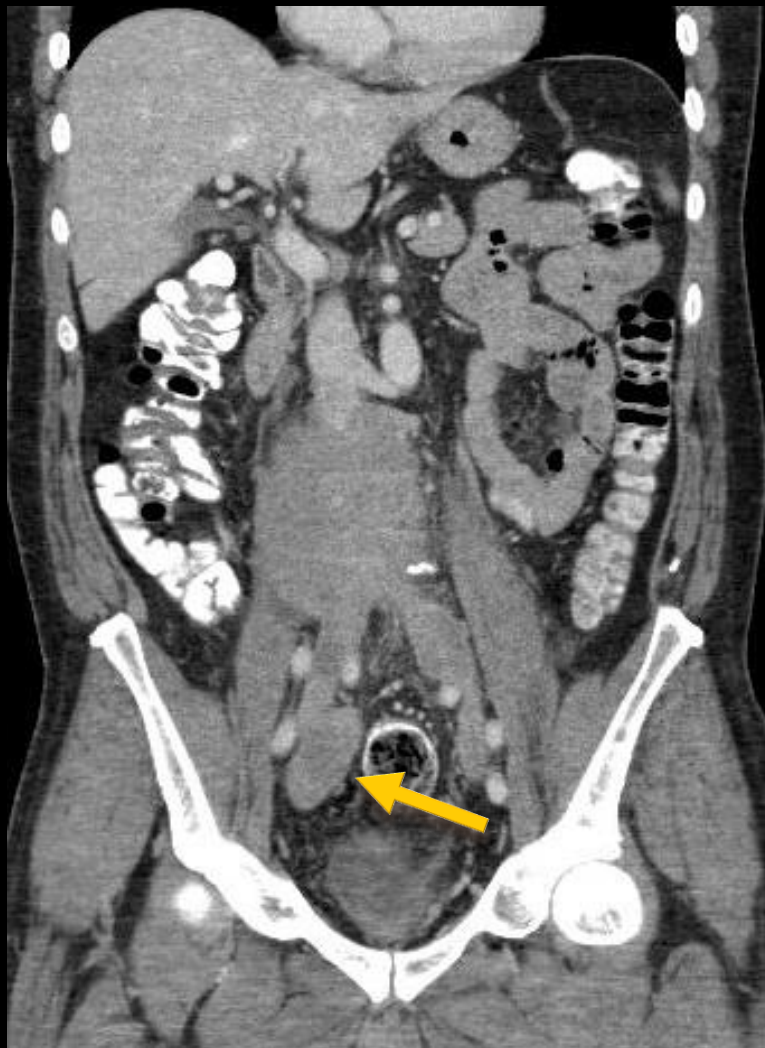


Renal Angiomyolipoma

Imaging Findings:

Lymph Node Metastases

- Note: Nodal metastases are **rare** in sarcomas, especially the common sarcomas
 - If nodal disease is prominent think **carcinoma**
 - We often see falsely reported nodal disease in sarcoma cases.
- Sarcomas with highest rate of adenopathy:
 - Angiosarcoma (14%)
 - Embryonal Rhabdomyosarcoma (14%)
 - Epithelioid Sarcoma (17%)
- Most common cause of metastatic nodes in sarcomas:
 - Leiomyosarcoma (3%)



Leiomyosarcoma of IVC

Metastatic adenopathy

GRAZIE MILLE!!

- Take time carefully scrutinizing the tumor
- Anatomical space
 - Intraperitoneal, retroperitoneal, extraperitoneal
- Look for arterial supply
 - May determine organ of origin
- Look for pedicles
 - Attachment to anatomical structure
- Internal contents
 - Any diagnostic features?
- Nodal disease
 - Rare!
 - Is it real? Is it carcinoma?