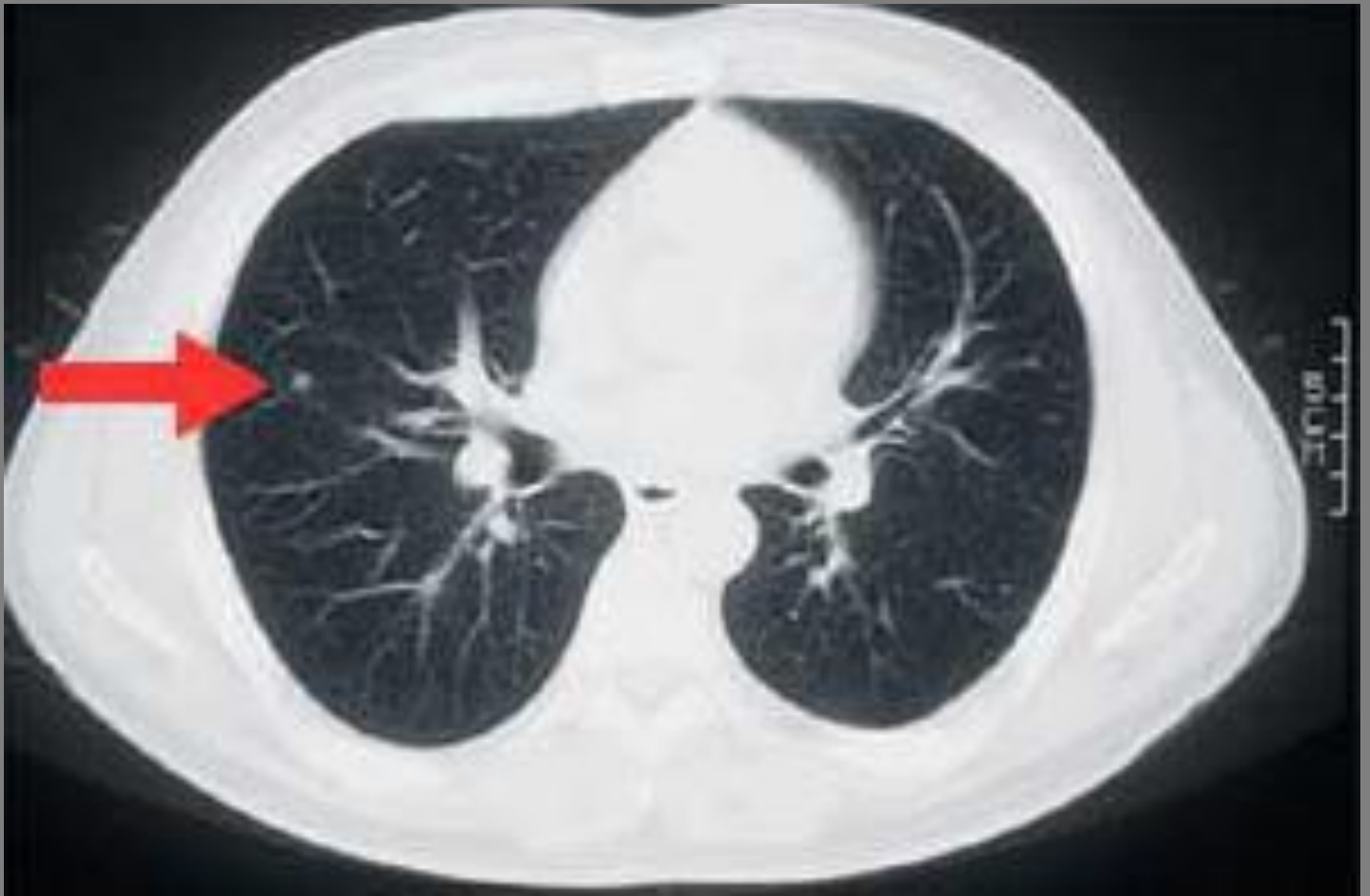


# *Incidentalomas in Radiology*



GRAND ROUNDS  
5/23/2017

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Boca Radiology Group

# Disclosures

NONE

# *Incidental Findings* **EVERYWHERE**

## How hospitals make sure 'incidental findings' don't fall through the cracks

### **Clinics, automated alerts prompt follow-up action**

9:01 AM - November 12, 2014

A third of imaging tests reveal "incidental findings" that were not related to the purpose of the test, but doctors often don't investigate further, the *Wall Street Journal's* Laura Landro reports.

Sayon Dutta, an ED physician at **Massachusetts General Hospital**, emphasizes the importance of acting on incidental findings, or abnormalities uncovered unintentionally and unrelated to the condition that prompted a test. "You had the luck of finding this thing early because you had a CT scan for another reason, and you should take advantage of that early detection to get the best care possible," he says.

But last year, a study in the *Annals of Emergency Medicine* found that only half of ED radiology reports that had notes on incidental findings were followed up on.

# INCIDENTAL FINDINGS

The Latest Management Recommendations



QUALITY IS OUR IMAGE

## **CT or MRI Abdomen/Pelvis:**

- Adrenal Lesions
- Pancreatic Cystic Lesions
- Renal Lesions
- Liver Lesions, no risk of HCC
- Liver Lesions, risk of HCC (LI-RADS)
- Splenic Lesions
- Lymph Node Findings
- Adnexal Lesions
- Gallbladder and Biliary Lesions

## **Ultrasound:**

- Cystic Adnexal Lesions
- Other Adnexal Lesions
- Thyroid Nodules

## **Chest:**

- Solid Pulmonary Nodules
- Subsolid Pulmonary Nodules \*new\*

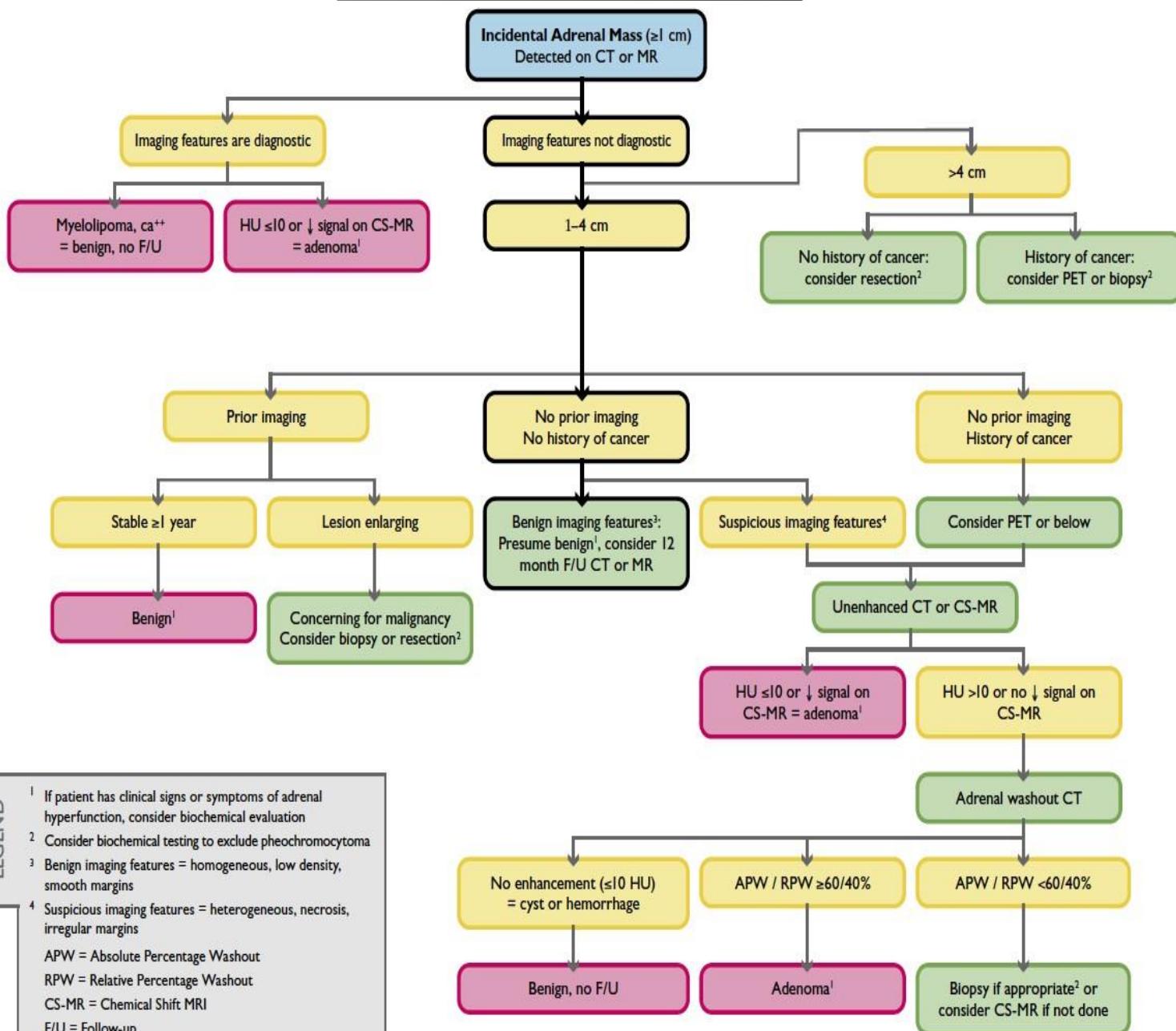
## **Vascular:**

- Abdominal Aortic or Iliac Aneurysms
- Splenic or Renal Aneurysms
- Other Abdominal Vascular Findings





# Incidental Adrenal Mass ≥ 1 cm detected on CT or MR



## LEGEND

- ¹ If patient has clinical signs or symptoms of adrenal hyperfunction, consider biochemical evaluation
  - ² Consider biochemical testing to exclude pheochromocytoma
  - ³ Benign imaging features = homogeneous, low density, smooth margins
  - ⁴ Suspicious imaging features = heterogeneous, necrosis, irregular margins
- APW = Absolute Percentage Washout  
 RPW = Relative Percentage Washout  
 CS-MR = Chemical Shift MRI  
 F/U = Follow-up  
 HU = Hounsfield Unit  
 ↓ = decreased

Source: [White Paper: Managing Incidental Findings on Abdominal CT, JACR, October 2011](#)

## Relevant Links:

[Washout Calculator](#)

[Caoli et al: CT Characterization of Adrenal Masses, Radiology, 2002](#)

[ACR Appropriateness Criteria for Incidental Adrenal Nodule, 2006](#)

[Song et al: Prevalence of Adrenal Disease in 1049 Consecutive Adrenal Masses, AJR, 2008](#)

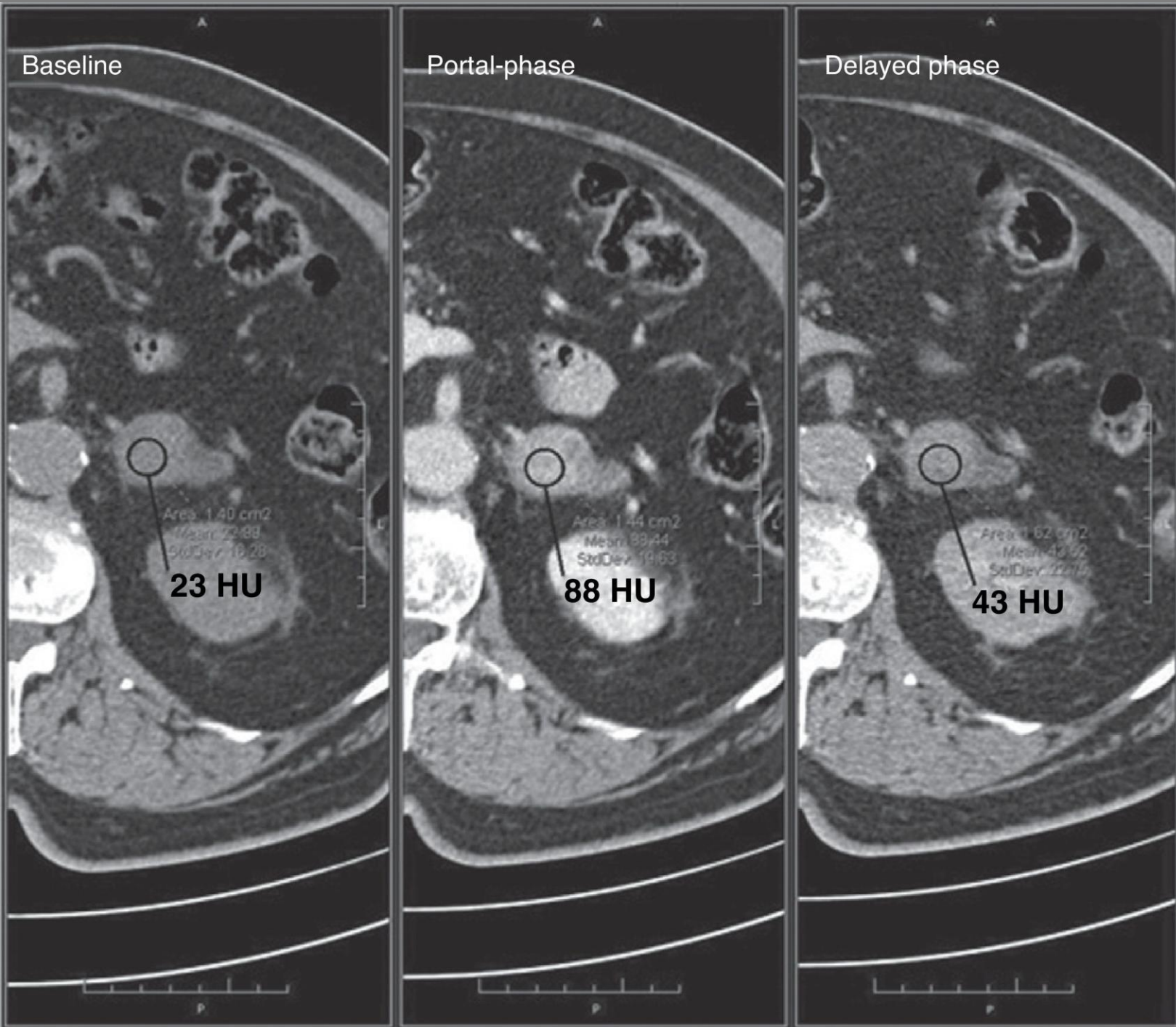
Of 1049 masses, 100% were benign in patients with no suspicion of malignancy.

Low attenuation (<10 HU)  
Right adrenal adenoma



No follow-up needed

# Indeterminate right adrenal nodule

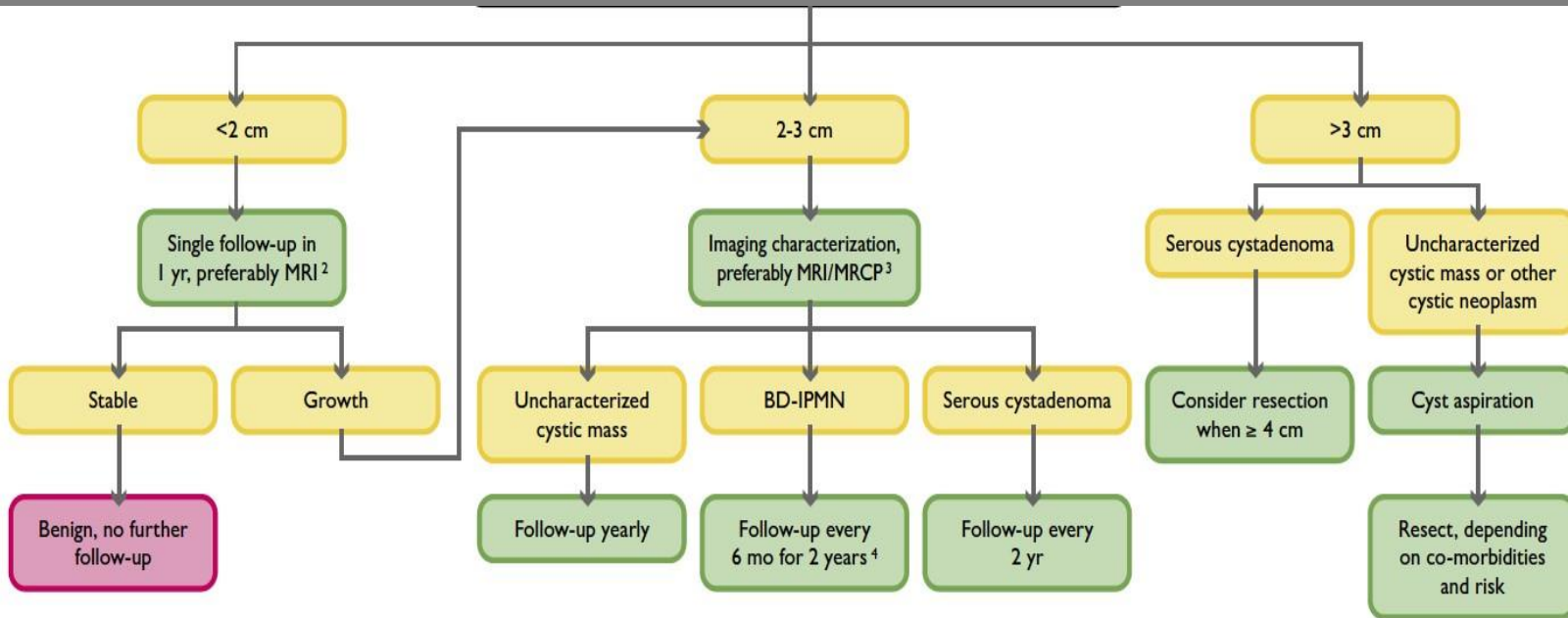


Adrenal protocol CT



# Incidental Cystic Pancreatic Mass

In an asymptomatic<sup>1</sup> patient, detected on CT, MRI (w/ or w/o contrast) or US.



**LEGEND**

- 1 Signs and symptoms include hyperamylasemia, recent onset diabetes, severe epigastric pain, weight loss, steatorrhea or jaundice.
- 2 Consider decreasing interval if younger, omitting with limited life expectancy. Recommend limited T2-weighted MRI for routine follow-ups.
- 3 Recommend pancreas-dedicated MRI with MRCP.
- 4 If no growth after 2 years, follow yearly. If growth OR suspicious features develop, consider resection.
- 5 BD-IPMN = branch duct intraductal papillary mucinous neoplasm.

Source: [White Paper: Managing Incidental Findings on Abdominal CT, JACR, October 2011](#)

**Some Relevant Links:**

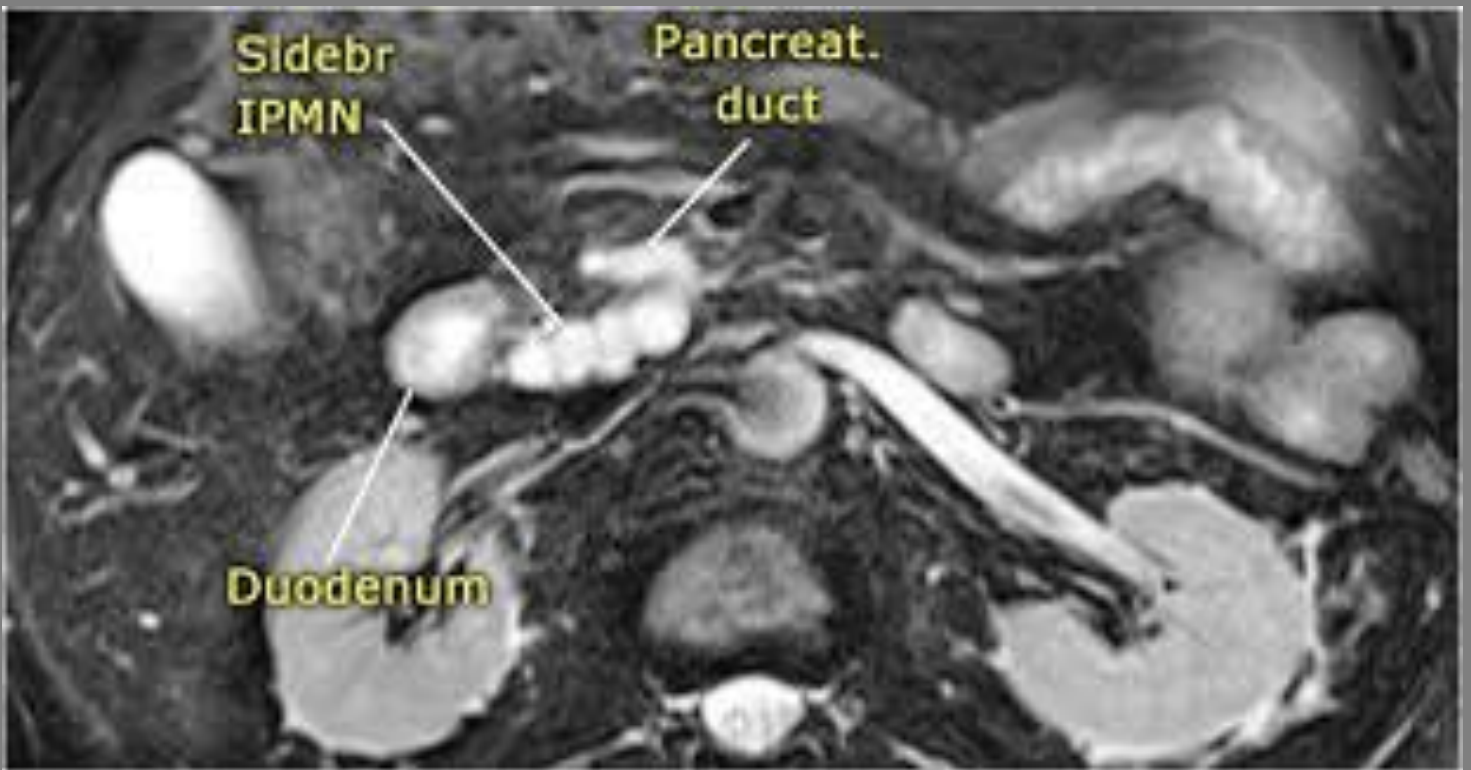
[Ip et. al., Focal Cystic Pancreatic Lesions: Variation in Management Recomm., Radiology, April 2011](#)

2.2% of CT's and 15.9% of MR's detect focal cystic pancreatic lesions.

[Sahani et. al., Pancreatic Cysts 3 cm or Smaller, Radiology, Mar: 2006](#)

87% of cysts <3cm were benign (75 of 86), 97% of unilocular cysts (35 of 36) were benign.

# Indeterminate Cystic Pancreatic Lesion (<2cm)



Follow-up MRI in 1 year

## Serous Cystadenoma



>4 cm = resection

# Indeterminate Cystic Renal Mass

**Bosniak I**



**Bosniak II**



**Bosniak IIF**



**Bosniak III**



**Bosniak IV**



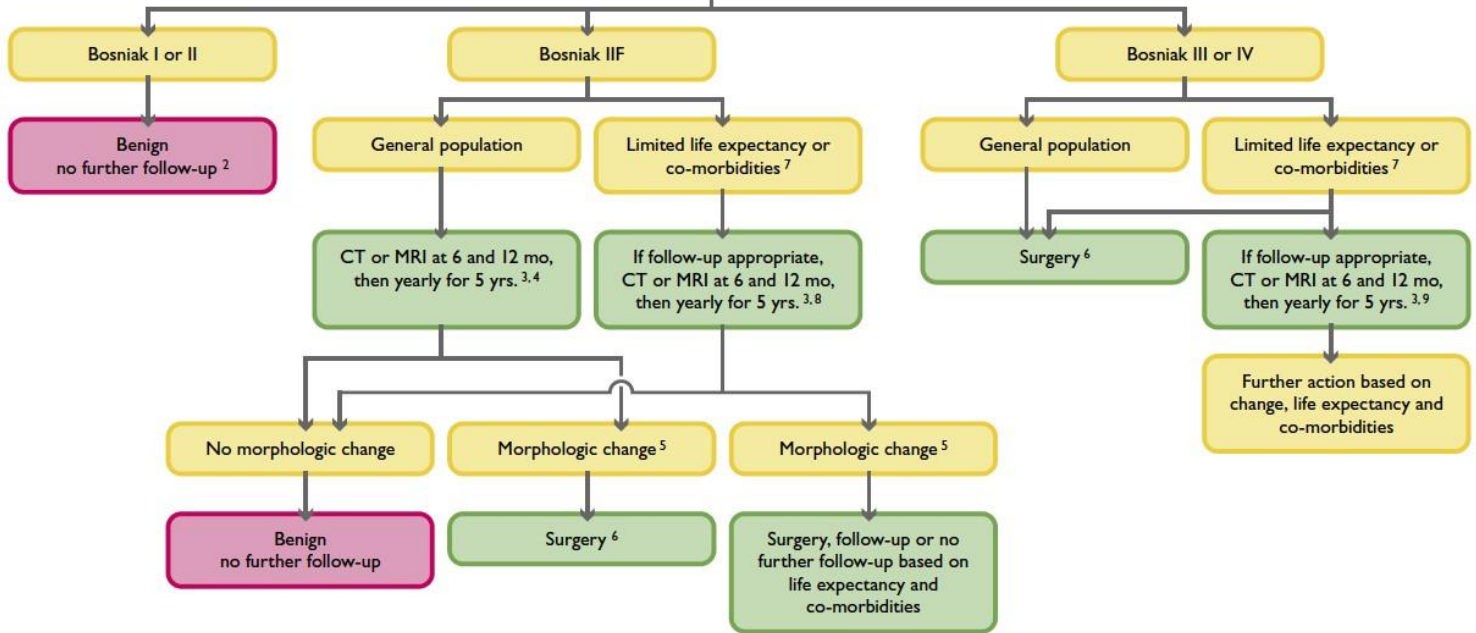
Copyright A. Michaleo - MD - Imaios

Bosniak I/II - no followup necessary

Bosniak IIF – 6 month followup renal CT or MRI

Bosniak III/IV – treated as cancer, require surgery

# Incidental Cystic Renal Mass detected on CT



LEGEND

- 1 These recommendations are to be followed only if non-neoplastic causes of a renal mass (e.g., infections) have been excluded; see Ref. 48 for details. The recommendations are offered as general guidance and do not necessarily apply to all patients. See Table 1 for detailed description of Bosniak Classification.
- 2 When a mass smaller than 1 cm has the appearance of a simple cyst, further work-up is not likely to yield useful information.
- 3 Interval and duration of observation may be varied (e.g., longer intervals may be chosen if the mass is unchanged; longer duration may be chosen for greater assurance).
- 4 In selected patients (e.g., young), early surgical intervention may be considered, particularly if a minimally invasive approach (e.g., laparoscopic partial nephrectomy) can be utilized.
- 5 Morphologic change refers to change in feature characteristics, such as number of septations or their thickness. Growth should be noted, but by itself does not indicate malignancy.
- 6 Surgical options include open or laparoscopic nephrectomy and partial nephrectomy; each provides a tissue diagnosis. Open, laparoscopic, and percutaneous ablation may be considered where available, but biopsy would be needed to achieve a tissue diagnosis. Long-term (5- or 10-year) results of ablation are not yet known.
- 7 Limited life expectancy and co-morbidities that increase the risk of treatment.
- 8 Cystic masses 1.5 cm or smaller that are not clearly simple cysts or that cannot be characterized completely may not require further evaluation in patients with co-morbidities and in patients with limited life expectancy.
- 9 Percutaneous biopsy of Bosniak Category III masses may be considered, but may not be diagnostic.

## Management of Incidental Solid Renal Masses:

**1. General Population:** If less than 1 cm, these masses may be observed until they are 1 cm or larger (i.e. CT or MR at 3-6 mo then 12 mo). Lesions larger than 1 cm should be surgically removed, however, hyperattenuating homogeneously enhancing masses less than 3 cm may warrant further characterization with MRI and/or biopsy as these may be angiomyolipomas with minimal fat.

**2. Limited Life Expectancy and Comorbidities:** If less than 1 cm, these masses may be observed until they are 1.5 cm or larger (i.e. CT or MR at 3-6 mo then 12 mo). Lesions 1-3 cm may be followed or surgically removed, however, hyperattenuating homogeneously enhancing masses less than 3 cm may warrant further characterization with MRI and/or biopsy as these may be angiomyolipomas with minimal fat. Lesions larger than 3 cm may be followed or surgically removed.

Source: [White Paper: Managing Incidental Findings on Abdominal CT, JACR, Oct, 2011](#)

## Bosniak Criteria:

**Category I:** Hairline-thin wall; no septa, calcifications, or solid components; water attenuation; no enhancement.

**Category II:** Few hairline-thin septa with or without perceived (not measurable) enhancement; fine calcification or short segment of slightly thickened calcification in the wall or septa; homogeneously high-attenuating masses ( $\leq 3$  cm) that are sharply margined and do not enhance.

**Category III:** Multiple hairline-thin septa with or without perceived (not measurable) enhancement, minimal smooth thickening of wall or septa that may show perceived (not measurable) enhancement, calcification may be thick and nodular but no measurable enhancement present; no enhancing soft tissue components; intrarenal nonenhancing high-attenuation renal masses ( $>3$  cm).

**Category III:** Thickened irregular or smooth walls or septa, with measurable enhancement.

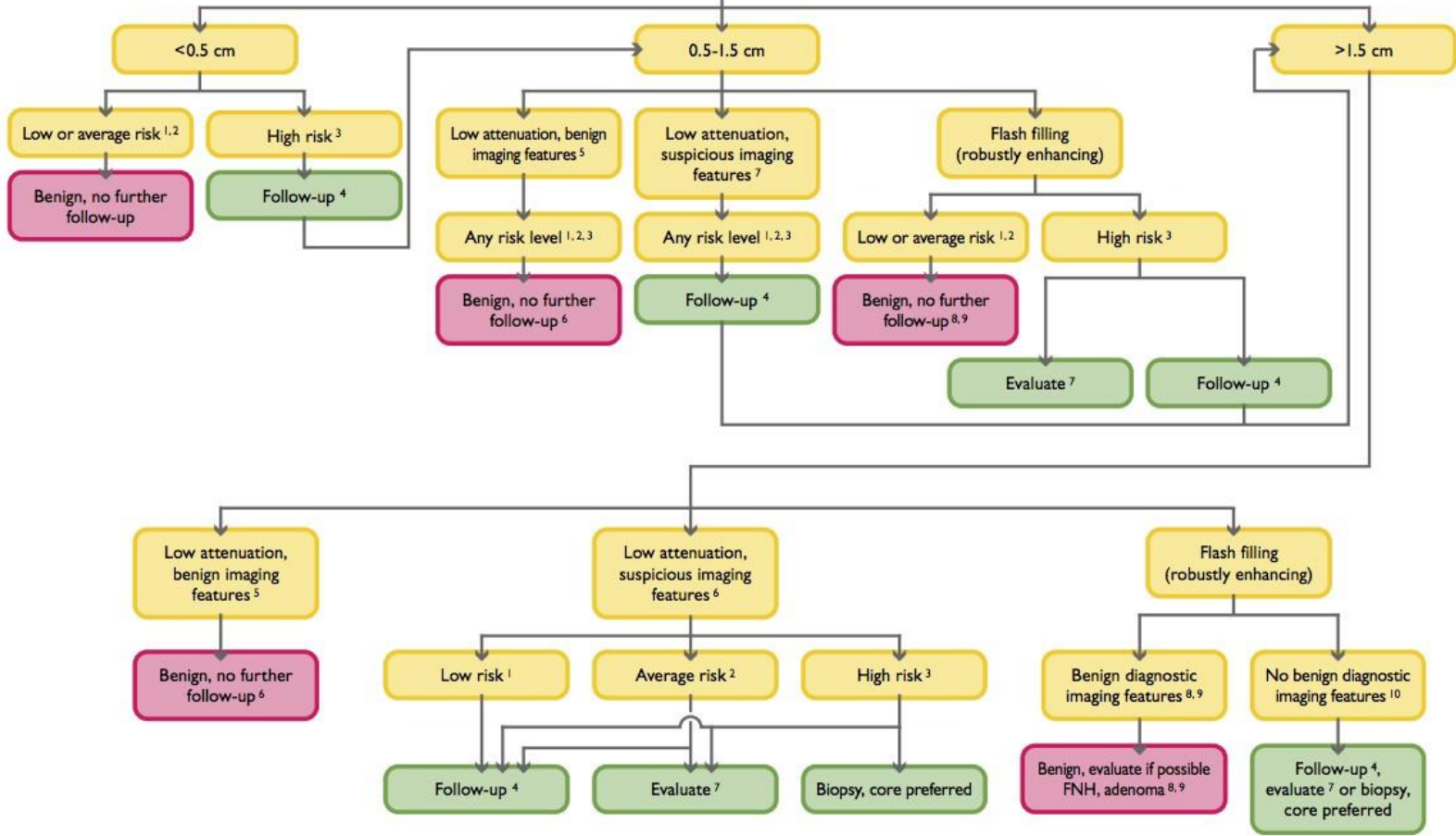
**Category IV:** Criteria of category III, but also containing enhancing soft tissue components adjacent to or separate from the wall or septa.

# BOSNIAK Category IIF



Follow-up in 6 months

# Incidental Liver Mass detected on CT

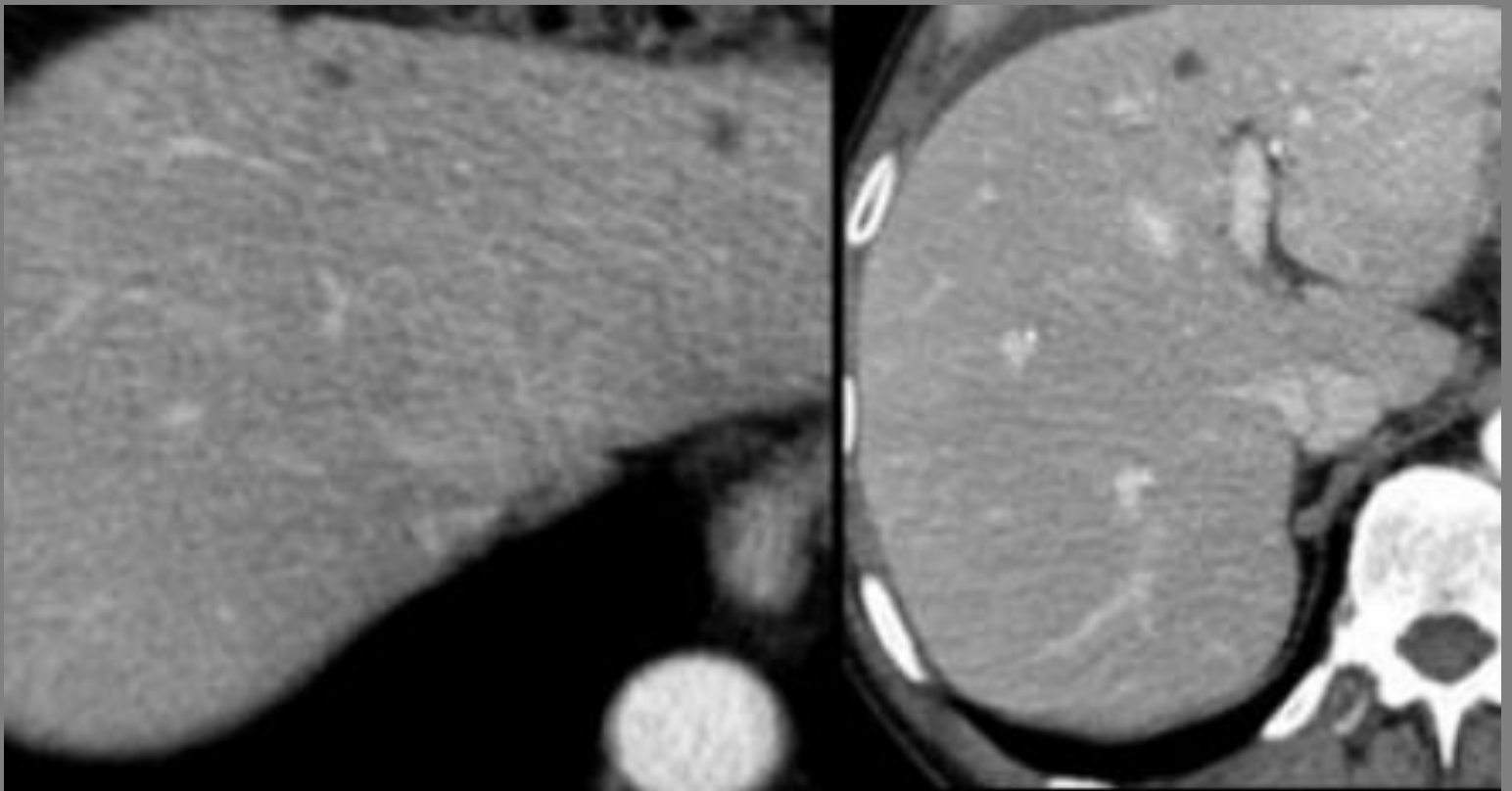


## Legend:

1. Low risk individuals: Young patient ( $\leq 40$  years old), with no known malignancy, hepatic dysfunction, hepatic malignant risk factors, or symptoms attributable to the liver.
2. Average risk individuals: Patient  $>40$  years old, with no known malignancy, hepatic dysfunction, abnormal liver function tests or hepatic malignant risk factors or symptoms attributable to the liver.
3. High risk individuals: Known primary malignancy with a propensity to metastasize to the liver, cirrhosis, and/or other hepatic risk factors. Hepatic risk factors include hepatitis, chronic active hepatitis, sclerosing cholangitis, primary biliary cirrhosis, hemochromatosis, hemosiderosis, oral contraceptive use, anabolic steroid use.
4. Follow-up CT or MRI in 6 months. May need more frequent follow-up in some situations, such as a cirrhotic patient who is a liver transplant candidate.
5. Benign imaging features: Typical hemangioma (see below), sharply marginated, homogeneous low attenuation (up to about 20 HU), no enhancement. May have sharp, but irregular margins.

6. Benign low attenuation masses: Cyst, hemangioma, hamartoma, Von Meyenberg complex (bile duct hamartomas).
7. Suspicious imaging features: Ill-defined margins, enhancement (more than about 20 HU), heterogeneous, enlargement. To evaluate, prefer multiphasic MRI.
8. Hemangioma features: Nodular discontinuous peripheral enhancement with progressive enlargement of enhancing foci on subsequent phases. Nodule isodense with vessels, not parenchyma.
9. Small robustly enhancing lesion in average risk, young patient: hemangioma, focal nodular hyperplasia (FNH), transient hepatic attenuation difference (THAD) flow artifact, and in average risk, older patient: hemangioma, THAD flow artifact. Other possible diagnoses: adenoma, arterio-venous malformation (AVM), nodular regenerative hyperplasia. Differentiation of FNH from adenoma important especially if larger than 4 cm and subcapsular.
10. Hepatocellular or common metastatic enhancing malignancy: islet cell, neuroendocrine, carcinoid, renal cell carcinoma, melanoma, choriocarcinoma, sarcoma, breast, some pancreatic lesions.

# “Too small to characterize” Lesions



## **TSTCs in patients without a known malignancy**

Jones (1992) studied 1500 patients who had an abdominal CT examination:

TSTC lesions in 17% of patients

In 45 pts without a known malignancy, all lesions were benign

In 209 pts with a known malignancy

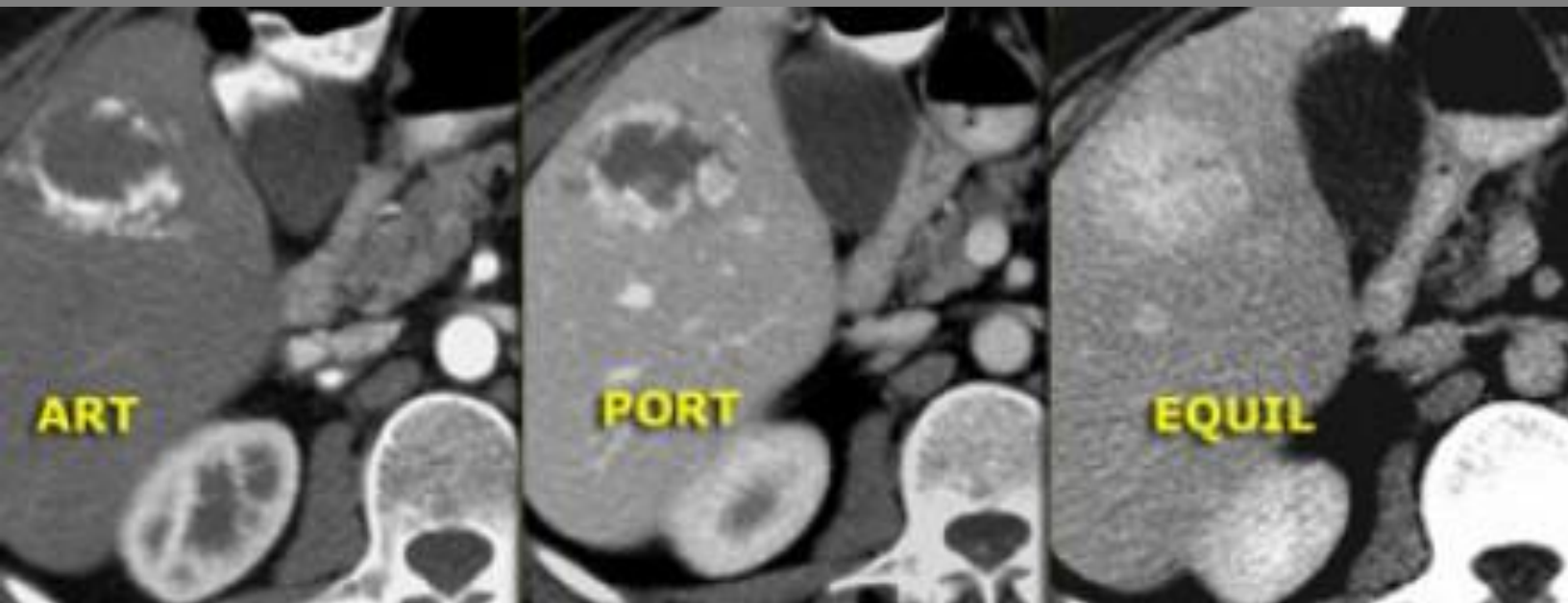
86 had 1 TSTC: 5% malignant

74 had 2-4 TSTCs: 19% malignant

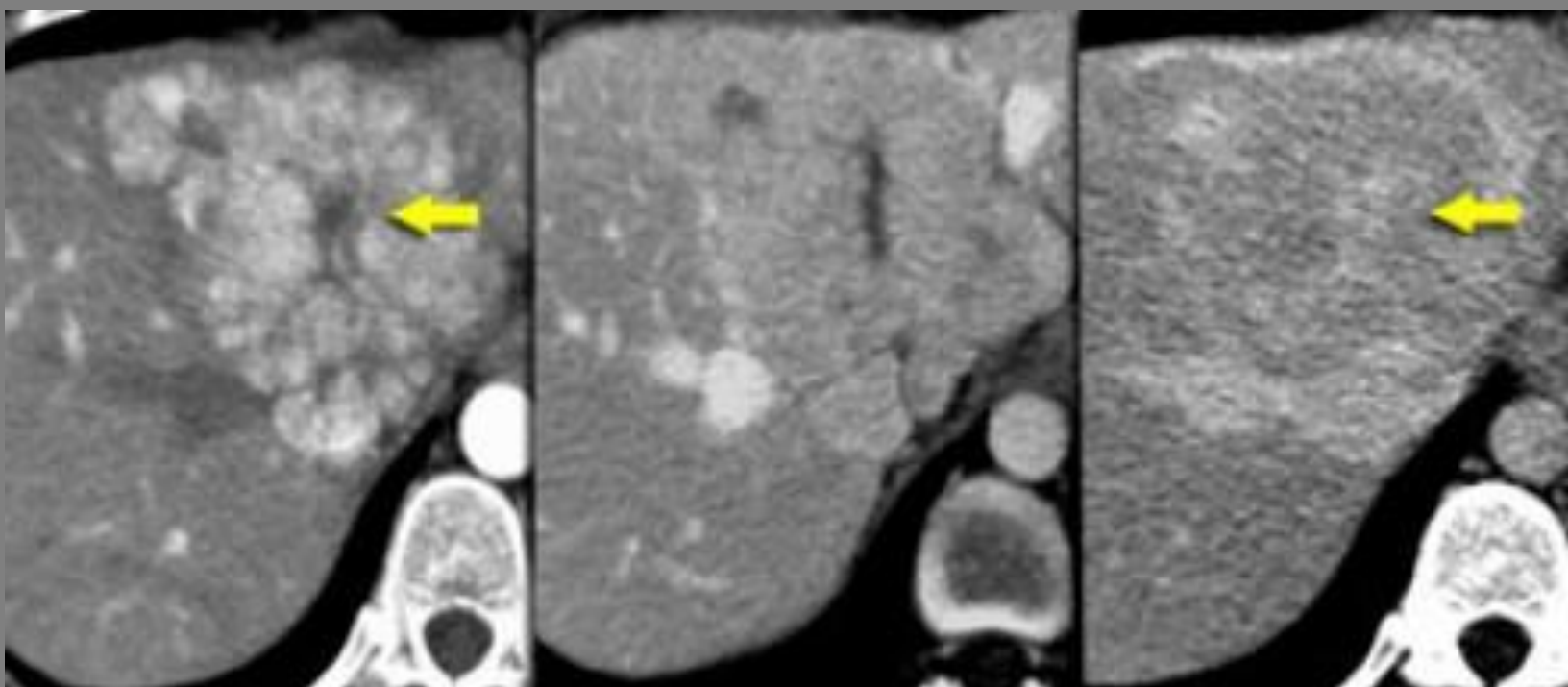
49 with >5 TSTCs: 76% malignant.



# Hypervascular Liver Lesions



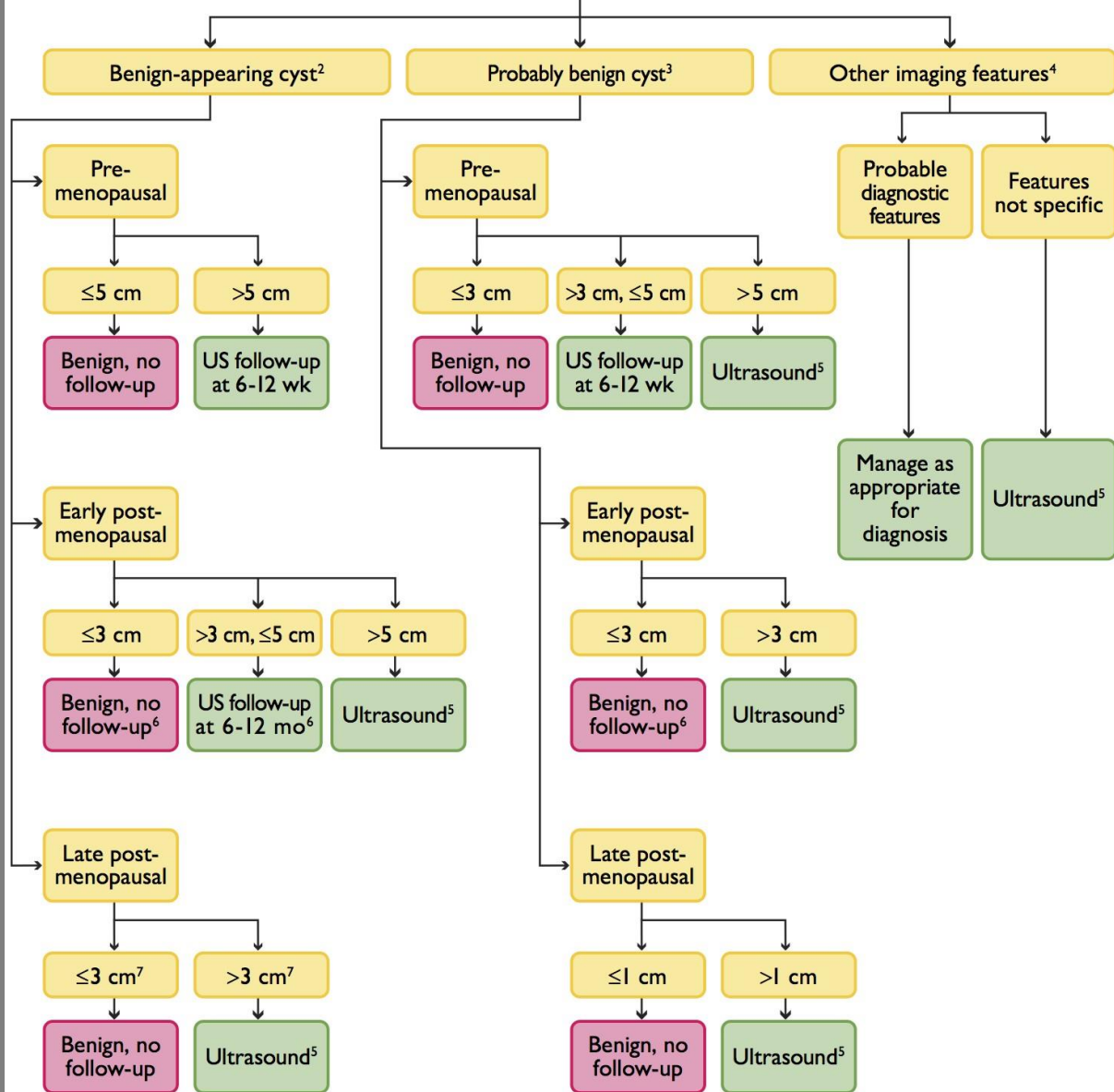
Classic Peripheral nodular discontinuous progressive enhancement = hemangioma



Arterial enhancement with central scar that fades to background on delay = FNH

# Incidental Adnexal Cystic Mass

(≥1 cm) on CT or MRI in Post-Menarchal, Non-Pregnant Females<sup>1</sup>



**1.Exclusions:** (a) normal findings, including hypodense ovary, crenulated enhancing wall of corpus luteum, asymmetric ovary (within 95% confidence interval for size) with normal shape; (b) unimportant findings, including calcifications without associated noncalcified mass; (c) previous characterization with ultrasound or MRI; and (d) documented stability in size and appearance for >2 years.

**2. Cyst:** should have all of the following features: (a) oval or round; (b) unilocular, with uniform fluid attenuation or signal (layering hemorrhage acceptable if premenopausal); (c) regular or imperceptible wall; (d) no solid area, mural nodule; and (e) <10 cm in maximum diameter.


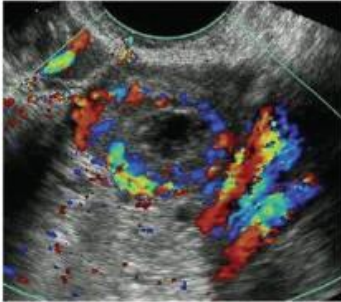

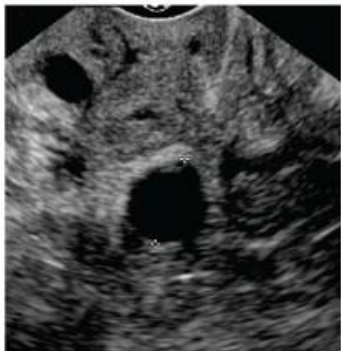
**3.** Refers to an adnexal cyst that would otherwise meet the criteria for a benign-appearing cyst except for one or more of the following specific observations: (a) angulated margins, (b) not round or oval in shape, (c) a portion of the cyst is poorly imaged (eg, a portion of the cyst may be obscured by metal streak artifact on CT of the pelvis), and (d) the image has reduced signal-to-noise ratio, usually because of technical parameters or in some cases because the study was performed without intravenous contrast.

**4.** Features of masses in this category include (a) solid component, (b) mural nodule, (c) septations, (d) higher than fluid attenuation, and (e) layering hemorrhage if postmenopausal.


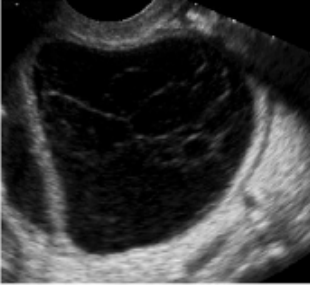
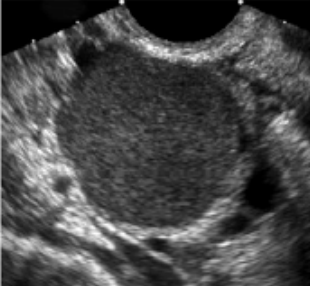



**5.** This indicates that ultrasound should be performed promptly for further evaluation, rather than in follow-up.

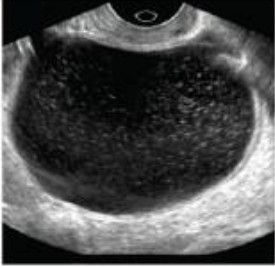
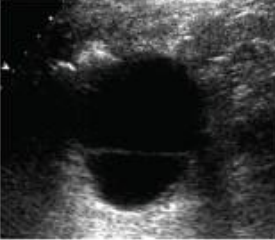



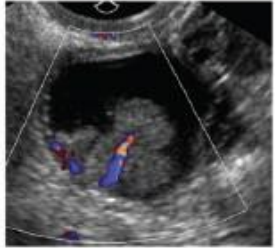
**6.** A benign-appearing cyst >5 cm with suspected internal hemorrhage in a patient aged >55 years, or within 5 years of menopause, should be followed in 6 to 12 weeks because hemorrhagic cysts in early postmenopause are possible, although rare.

**7.** May decrease threshold from 3 cm to lower values down to 1 cm to increase sensitivity for neoplasm.

| Normal Appearance   |   | Follow-up* | Comments   |
|---|---|------------|--|
| <p>Normal ovary appearance:<br/>Reproductive age<br/>Follicles</p> <ul style="list-style-type: none"> <li>• Thin and smooth walls</li> <li>• Round or oval</li> <li>• Anechoic</li> <li>• Size <math>\leq</math> 3 cm</li> <li>• No blood flow</li> </ul>                                   |    | Not needed | Developing follicles and dominant follicle $\leq$ 3 cm are normal findings             |
| <p>Normal ovary appearance:<br/>Reproductive age<br/>Corpus luteum</p> <ul style="list-style-type: none"> <li>• Diffusely thick wall</li> <li>• Peripheral blood flow</li> <li>• Size <math>\leq</math> 3 cm</li> <li>• +/- internal echoes</li> <li>• +/- crenulated appearance</li> </ul> |    | Not needed | Corpus luteum $\leq$ 3 cm is a normal finding  |
| <p>Normal ovary appearance:<br/>Postmenopausal</p> <ul style="list-style-type: none"> <li>• Small</li> <li>• Homogenous</li> </ul>  |   | Not needed | Normal postmenopausal ovary is atrophic without follicles                              |
| <p>Clinically inconsequential:<br/>Postmenopausal<br/>Simple cyst <math>\leq</math> 1 cm</p> <ul style="list-style-type: none"> <li>• Thin wall</li> <li>• Anechoic</li> <li>• No flow</li> </ul>   |  | Not needed | Small simple cysts are common; cysts $\leq$ 1 cm are considered clinically unimportant |

Summary of recommendations for management of asymptomatic ovarian and other adnexal cysts. \* = Follow-up recommendations are for US, unless otherwise indicated. \*\* = Some practices may choose a threshold size slightly higher than 1 cm before recommending yearly follow-up. Practices may choose to decrease the frequency of follow-up once stability or decrease in size has been confirmed. (Figure continues.)

| Cysts with benign characteristics  |   | Follow-up*   | Comments  |
|--|---|--|---|
| <p>Simple cysts (includes ovarian and extraovarian cysts)</p> <ul style="list-style-type: none"> <li>• Round or oval</li> <li>• Anechoic</li> <li>• Smooth, thin walls</li> <li>• No solid component or septation</li> <li>• Posterior acoustic enhancement</li> <li>• No internal flow</li> </ul> |    | <p>Reproductive age:<br/>           ≤ 5 cm: Not needed<br/>           &gt; 5 &amp; ≤ 7 cm: Yearly</p> <p>Postmenopausal (PM):<br/>           &gt; 1 &amp; ≤ 7 cm: Yearly**</p> <p>Any age: &gt; 7 cm: Further imaging (e.g., MRI) or surgical evaluation</p> | <p>Simple cysts, regardless of age of patient, are almost certainly benign</p> <p>For cysts ≤ 3 cm in women of reproductive age, it is at discretion of interpreting physician whether to describe them in imaging report</p> |
| <p>Hemorrhagic cyst</p> <ul style="list-style-type: none"> <li>• Reticular pattern of internal echoes</li> <li>• +/- Solid appearing area with concave margins</li> <li>• No internal flow</li> </ul>  |    | <p>Reproductive age:<br/>           ≤ 5 cm: Not needed<br/>           &gt; 5 cm: 6-12 week follow-up to ensure resolution</p> <p>Early PM:<br/>           Any size: Follow-up to ensure resolution</p> <p>Late PM: Consider surgical evaluation</p>          | <p>Use Doppler to ensure no solid elements</p> <p>For cysts ≤ 3 cm in women of reproductive age, it is at the discretion of interpreting physician whether to describe them in imaging report</p>                             |
| <p>Endometrioma</p> <ul style="list-style-type: none"> <li>• Homogeneous low level internal echoes</li> <li>• No solid component</li> <li>• +/- Tiny echogenic foci in wall</li> </ul>   |   | <p>Any age:<br/>           Initial follow-up 6-12 weeks, then if not surgically removed, follow-up yearly</p>  |   |
| <p>Dermoid</p> <ul style="list-style-type: none"> <li>• Focal or diffuse hyperechoic component</li> <li>• Hyperechoic lines and dots</li> <li>• Area of acoustic shadowing</li> <li>• No internal flow</li> </ul>  |  | <p>Any age:<br/>           If not surgically removed, follow-up yearly to ensure stability</p>   |   |
| <p>Hydrosalpinx</p> <ul style="list-style-type: none"> <li>• Tubular shaped cystic mass</li> <li>• +/- Short round projections "beads on a string"</li> <li>• +/- Waist sign (i.e. indentations on opposite sides).</li> <li>• +/- Seen separate from the ovary</li> </ul>                         |  | <p>Any age:<br/>           As clinically indicated</p>   |   |
| <p>Peritoneal inclusion cyst</p> <ul style="list-style-type: none"> <li>• Follow the contour of adjacent pelvic organs</li> <li>• Ovary at the edge of the mass or suspended within the mass</li> <li>• +/- Septations</li> </ul>  |  | <p>Any age:<br/>           As clinically indicated</p>   |   |

| Cysts with indeterminate, but probably benign, characteristics                           |   | Follow-up*   | Comments   |
|--|---|--|--|
| Findings suggestive of, but not classic for, hemorrhagic cyst, endometrioma or dermoid   |    | Reproductive age: 6-12 week follow-up to ensure resolution. If the lesion is unchanged, then hemorrhagic cyst is unlikely, and continued follow-up with either ultrasound or MRI should then be considered. If these studies do not confirm an endometrioma or dermoid, then surgical evaluation should be considered.<br><br>Postmenopausal: Consider surgical evaluation |  |
| Thin-walled cyst with single thin septation or focal calcification in the wall of a cyst |    | Follow-up based on size and menopausal status, same as simple cyst described above   |  |
| Multiple thin septations (< 3 mm)  |   | Consider surgical evaluation   | Multiple septations suggest a neoplasm, but if thin, the neoplasm is likely benign   |
| Nodule (non-hyperechoic) without flow  |  | Consider surgical evaluation or MRI  | Solid nodule suggests neoplasm, but if no flow (and not echogenic as would be seen in a dermoid) this is likely a benign lesion such as a cystadenofibroma |
| Cysts with characteristics worrisome for malignancy                                      |   | Follow-up*   | Comments   |
| Thick (> 3 mm) irregular septations  |  | Any age: Consider surgical evaluation  |  |
| Nodule with blood flow   |  | Any age: Consider surgical evaluation  |  |

Source: [Levine et. al. Management of Asymptomatic Ovarian and Other Adnexal Cysts Imaged at US, Society of Radiologists in Ultrasound Consensus Statement, Ultrasound Quarterly 2010;26:121-131.](#)

## Management of Thyroid Nodules detected by ultrasound.

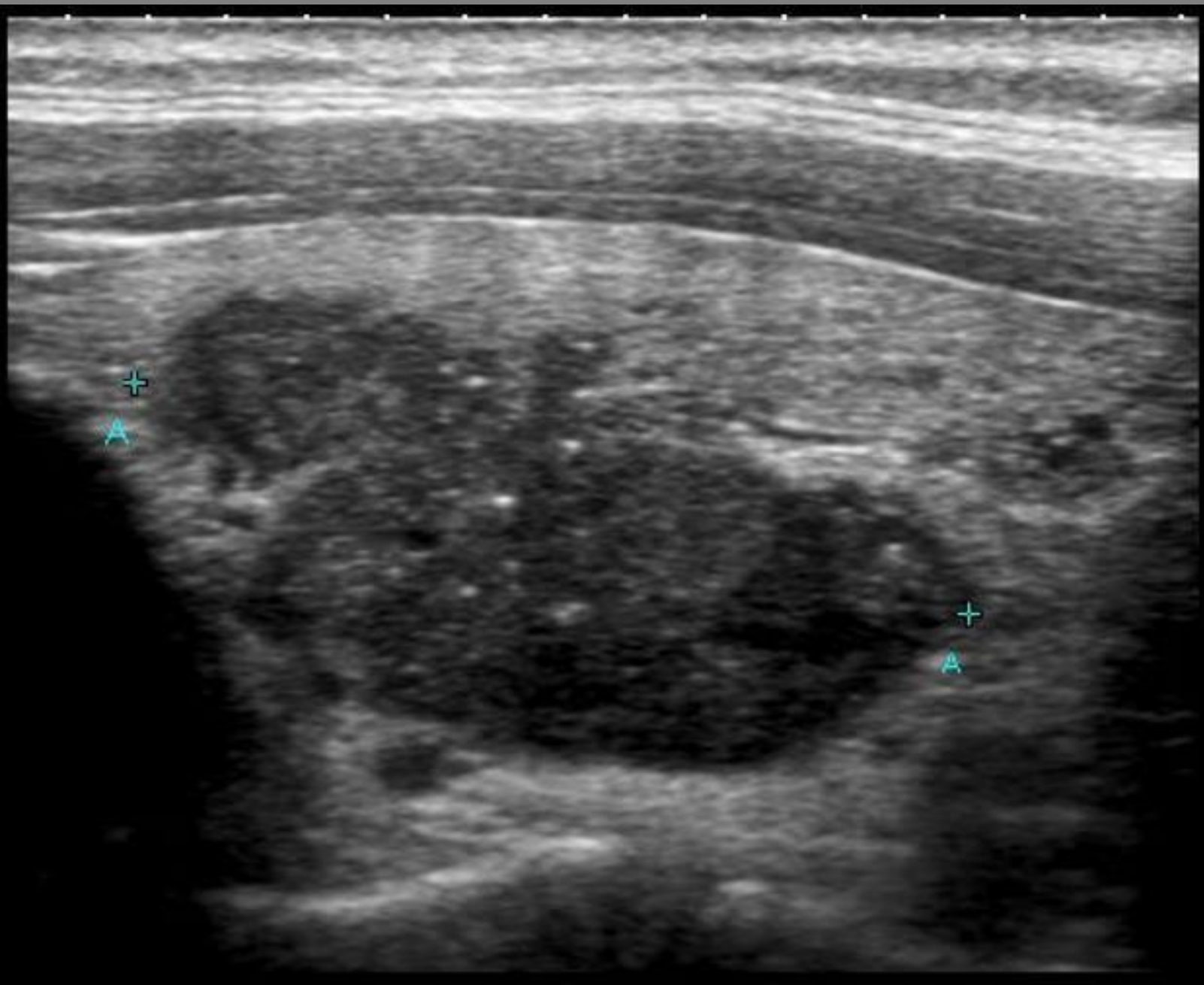
| Ultrasound Feature  | Recommendation   |
|---|--|
| Microcalcifications   | Strongly consider US-guided FNA if $\geq 1.0$ cm   |
| Solid (or almost entirely solid) and/or coarse calcifications.                          | Strongly consider US-guided FNA if $\geq 1.5$ cm   |
| Mixed solid and cystic, or almost entirely cystic with solid mural component.           | Consider US-guided FNA if $\geq 2.0$ cm  |
| Substantial growth since prior US exam.   | Consider US-guided FNA   |
| Almost entirely cystic and none of the above and no substantial growth (or no prior US) | US-guided FNA probably unnecessary   |
| Multiple nodules  | Consider US-guided FNA of one or more nodules, with selection prioritized on basis of criteria (in order listed) for solitary nodule |

**Note:** Use largest measurement for size. FNA is likely unnecessary in a diffusely enlarged gland with multiple nodules of similar US appearance *without* intervening normal parenchyma. Presence of abnormal lymph nodes overrides US features of thyroid nodule(s) and should prompt US-guided FNA or biopsy of lymph node and/or ipsilateral nodule.

| Ultrasound Features Associated with Thyroid Cancer | Sensitivity (%) | Specificity (%) | Positive Predictive Value (%) | Negative Predictive Value (%) |
|--|-----------------|-----------------|-------------------------------|-------------------------------|
| Microcalcifications                                | 26 - 59         | 86 - 95         | 24 - 71                       | 42 - 94                       |
| Hypoechoic   | 27 - 87         | 43 - 94         | 11 - 68                       | 74 - 94                       |
| Irregular margins or no halo                       | 17 - 78         | 39 - 85         | 9 - 60                        | 39 - 98                       |
| Solid  | 69 - 75         | 53 - 56         | 16 - 27                       | 88 - 92                       |
| Intranodule vascularity                            | 54 - 74         | 79 - 81         | 24 - 42                       | 86 - 97                       |
| More tall than wide                                | 33              | 93              | 67                            | 75                            |

**Note:** Combining these factors improves the positive predictive value of US. For example, a predominantly solid nodule with microcalcifications has a 31.6% likelihood of being cancer, as compared to a predominantly cystic nodule with no calcification, which has a 1.0% likelihood of being cancer.

# Thyroid Microcalcifications



# Management of Pulmonary Nodules

## newly detected incidentally at nonscreening CT in persons 35 or older

### Fleischner Society 2017 Guidelines for Management of Incidentally Detected Pulmonary Nodules in Adults

#### A: Solid Nodules\*

| Nodule Type     | Size                          |   |   | Comments  |
|-----------------|-------------------------------|---|---|---|
|                 | <6 mm (<100 mm <sup>3</sup> ) | 6–8 mm (100–250 mm <sup>3</sup> )                   | >8 mm (>250 mm <sup>3</sup> )                       |   |
| <b>Single</b>   |                               |   |   |   |
| Low risk†       | No routine follow-up          | CT at 6–12 months, then consider CT at 18–24 months | Consider CT at 3 months, PET/CT, or tissue sampling | Nodules <6 mm do not require routine follow-up, but certain patients at high risk with suspicious nodule morphology, upper lobe location, or both may warrant 12-month follow-up (recommendation 1A). |
| High risk†      | Optional CT at 12 months      | CT at 6–12 months, then CT at 18–24 months          | Consider CT at 3 months, PET/CT, or tissue sampling | Nodules <6 mm do not require routine follow-up, but certain patients at high risk with suspicious nodule morphology, upper lobe location, or both may warrant 12-month follow-up (recommendation 1A). |
| <b>Multiple</b> |                               |   |   |   |
| Low risk†       | No routine follow-up          | CT at 3–6 months, then consider CT at 18–24 months  | CT at 3–6 months, then consider CT at 18–24 months  | Use most suspicious nodule as guide to management. Follow-up intervals may vary according to size and risk (recommendation 2A).   |
| High risk†      | Optional CT at 12 months      | CT at 3–6 months, then at 18–24 months              | CT at 3–6 months, then at 18–24 months              | Use most suspicious nodule as guide to management. Follow-up intervals may vary according to size and risk (recommendation 2A).   |

#### † Low risk is defined as:

Minimal or absent history of smoking or other known risk factors.

#### ‡ High risk is defined as one or more of the following:

- ≥ 20 pack-year history of smoking, or equivalent second-hand exposure.
- Personal history of cancer or family history of lung cancer.
- Occupational exposure (asbestos, beryllium, silica, uranium, radon).
- Chronic interstitial/fibrotic lung disease.

#### § Low risk patient with ≤ 4 mm nodule:

The risk of malignancy in this category (1%) is substantially less than that in a baseline CT scan of an asymptomatic smoker.

**Young Patients:** Primary lung cancer is rare in persons under 35 years of age (1% of all cases), and the risks from radiation exposure are greater than in the older population. Therefore, unless there is a known primary cancer, multiple follow-up CT studies for small incidentally detected nodules should be avoided in young patients. In such cases, a single low-dose follow-up CT scan in 6–12 months should be considered.

#### Caution:

1. Fever: In certain clinical settings, such as a patient presenting with neutropenic fever, the presence of a nodule may indicate active infection, and short-term imaging follow-up or intervention may be appropriate.

2. Cancer: Guidelines may not apply for individuals with known or suspected malignant disease.



# Subsolid Pulmonary Nodules

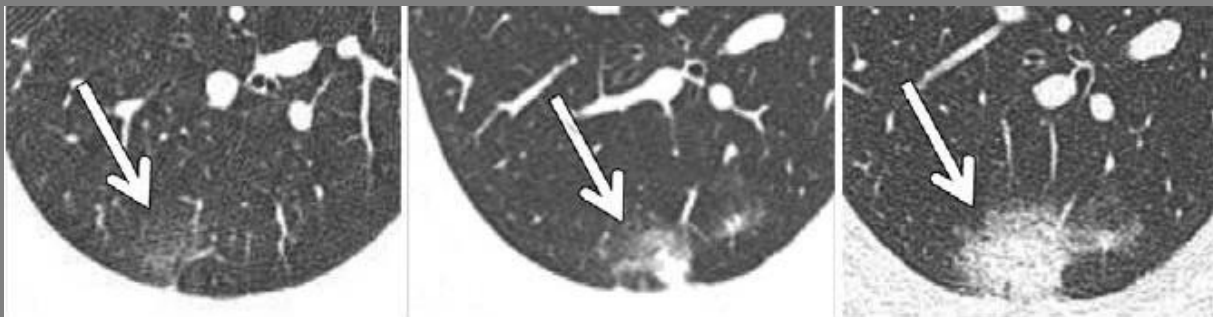
## Fleischner Society Recommendations for Subsolid Nodules Found on CT

The development of a standardized approach to the interpretation and management of subsolid nodules remains critically important given that peripheral adenocarcinomas represent the most common type of lung cancer, with evidence of increasing frequency.

### B: Subsolid Nodules\*

| Nodule Type  | Size   |   | Comments  |
|--------------|--|---|---|
|              | <6 mm (<100 mm <sup>3</sup> )                              | ≥6 mm (>100 mm <sup>3</sup> )   |   |
| Single       |  |   |   |
| Ground glass | No routine follow-up                                       | CT at 6–12 months to confirm persistence, then CT every 2 years until 5 years   | In certain suspicious nodules < 6 mm, consider follow-up at 2 and 4 years. If solid component(s) or growth develops, consider resection. (Recommendations 3A and 4A).   |
| Part solid   | No routine follow-up                                       | CT at 3–6 months to confirm persistence. If unchanged and solid component remains <6 mm, annual CT should be performed for 5 years. | In practice, part-solid nodules cannot be defined as such until ≥6 mm, and nodules <6 mm do not usually require follow-up. Persistent part-solid nodules with solid components ≥6 mm should be considered highly suspicious (recommendations 4A-4C) |
| Multiple     | CT at 3–6 months. If stable, consider CT at 2 and 4 years. | CT at 3–6 months. Subsequent management based on the most suspicious nodule(s).   | Multiple <6 mm pure ground-glass nodules are usually benign, but consider follow-up in selected patients at high risk at 2 and 4 years (recommendation 5A).   |

**Note:** These guidelines assume meticulous evaluation, optimally with contiguous thin sections (1 mm) reconstructed with narrow and/or mediastinal windows to evaluate the solid component and wide and/or lung windows to evaluate the nonsolid component of nodules, if indicated. When electronic calipers are used, bidimensional measurements of both the solid and ground-glass components of lesions should be obtained as necessary. With serial scans, always compare with the original baseline study to detect subtle indolent growth. The use of a consistent low-dose technique is recommended, especially in cases for which prolonged follow-up is recommended, particularly in younger patients. **See example:**



**Figure 4:** Value of initial short-term follow-up of malignant GGNs. Consecutive 1-mm-thick sections through right lower lobe section obtained at same anatomic level over a 6-month period (A, baseline; B, 3 months; C, 6 months) show rapid transformation of initial pure GGN (arrow in A) to a predominantly part-solid lesion (arrow in B and C), which subsequently proved to be mucinous adenocarcinoma.

**Source:** [Naidich et al. Recommendations for the Management of Subsolid Pulmonary Nodules Detected at CT: A Statement from the Fleischner Society. Radiology. January 2013.](#)



## Abdominal Aortic Aneurysms

And ectatic abdominal aortas - recommended intervals for initial follow-up imaging

| Aortic Diameter (cm) | Imaging Interval  |
|----------------------|---|
| 2.5 - 2.9 cm         | 5 years (defined as ectatic)                                  |
| 3.0 - 3.4 cm         | 3 years   |
| 3.5 - 3.9 cm         | 2 years   |
| 4.0 - 4.4 cm         | 1 year  |
| 4.5 - 4.9 cm         | 6 months - also consider surgical or endovascular referral.   |
| 5.0 - 5.5 cm         | 3-6 months - also consider surgical or endovascular referral. |

**Note:** An abdominal aorta  $\geq 1.5$  times the normal diameter or  $\geq 3.0$  cm or is defined as aneurysmal. For abdominal aortic diameters  $< 2.5$  cm, follow-up is generally thought to be unnecessary. Because the rupture of smaller abdominal aortic aneurysms is less likely, we recommend longer intervals between follow-up examinations. Follow-up intervals may vary depending on comorbidities and the growth rate of the aneurysm.

## Iliac Artery Aneurysms

Recommended intervals for initial follow-up imaging of common/internal/external iliac artery aneurysms

| Aneurysm Diameter (cm) | Imaging Interval                          |
|------------------------|---|
| $< 3.0$ cm             | No explicit recommendation is made*       |
| 3.0 - 3.5 cm           | 6-month follow-up cross-sectional imaging |
| $> 3.5$ cm             | Close follow-up or expeditious treatment  |

\*The white paper says, "Aneurysms that are  $< 3.0$  cm in diameter tend to be asymptomatic, rarely rupture, and expand slowly" and no recommendation is made. Simply describe the finding.

**Note:** Iliac artery aneurysm is defined as a diameter  $> 1.5$  times normal, or  $\geq 2.5$  cm in diameter.

## Penetrating Aortic Ulcers

Recommendations for follow-up imaging in asymptomatic patients

**Annual follow-up is recommended when asymptomatic, and more frequently if symptoms arise, with consideration of surgical/endovascular intervention.**

**Note:** Lack of symptoms does not necessarily imply stability. Studies have shown that the natural history of penetrating aortic ulcers (PAU) is variable and unpredictable. A PAU (which represents disruption of atherosclerotic plaque with penetration of luminal blood for variable distances into or through the aortic wall) may progress to an intramural hematoma, focal dissection, or pseudoaneurysm/rupture, or it may completely resolve.

Source: [White Paper: Managing Incidental Findings on Abdominal/Pelvic CT and MRI, Part 2: Vascular Findings, JACR, October 2013](#)



## Splenic Artery Aneurysms

### Recommended intervals for initial follow-up imaging

| Aneurysm Diameter (cm) | Imaging Interval                 |
|------------------------|----------------------------------|
| < 2.0 cm               | Yearly follow-up is recommended* |
| ≥ 2.0 cm               | Consider endovascular treatment  |

\*Clinical risk factors for rupture should be carefully assessed (such as attributable symptoms, a woman of child-bearing years, and cirrhosis, especially when associated with alpha-1 antitrypsin deficiency).

**Note:** Aneurysms showing rapid increase in size should be treated. Surveillance intervals greater than 1 year may be reasonable in patients with comorbidities and/or limited life expectancy.

## Renal Artery Aneurysms

### Recommended intervals for initial follow-up imaging

| Aneurysm Diameter (cm) | Imaging Interval                            |
|------------------------|---|
| 1.0 - 1.5 cm           | 1-2 year follow-up imaging                  |
| > 1.5 to 2.0 cm        | Consider surgical or endovascular treatment |

Note: Consider the alternate diagnosis of a pseudoaneurysm due to trauma. Evaluate for evidence of fibromuscular dysplasia, particularly in younger women. The decision to treat a renal artery aneurysm should be based on factors including patient age, gender, presence of hypertension, and aneurysm location and size.

Vascular recommendations continued on next page...

## Other Abdominal Vascular Findings

**Pancreaticoduodenal aneurysms** are felt to be at higher risk for rupture, and some authors recommend that all of these aneurysms undergo surgical or endovascular treatment regardless of size. If a decision is made to observe rather than treat, repeat scanning at annual intervals is recommended.

Treatment is generally recommended for **aneurysms >2 cm in diameter**; possibly with a smaller threshold for nonatherosclerotic aneurysms. For **hepatic aneurysms**, Abbas et al established that multiplicity and nonatherosclerotic origin were linked to increased rupture rate.

Researchers have found that **isolated visceral arterial dissections** (typically the SMA) can be followed rather than treated promptly when asymptomatic.

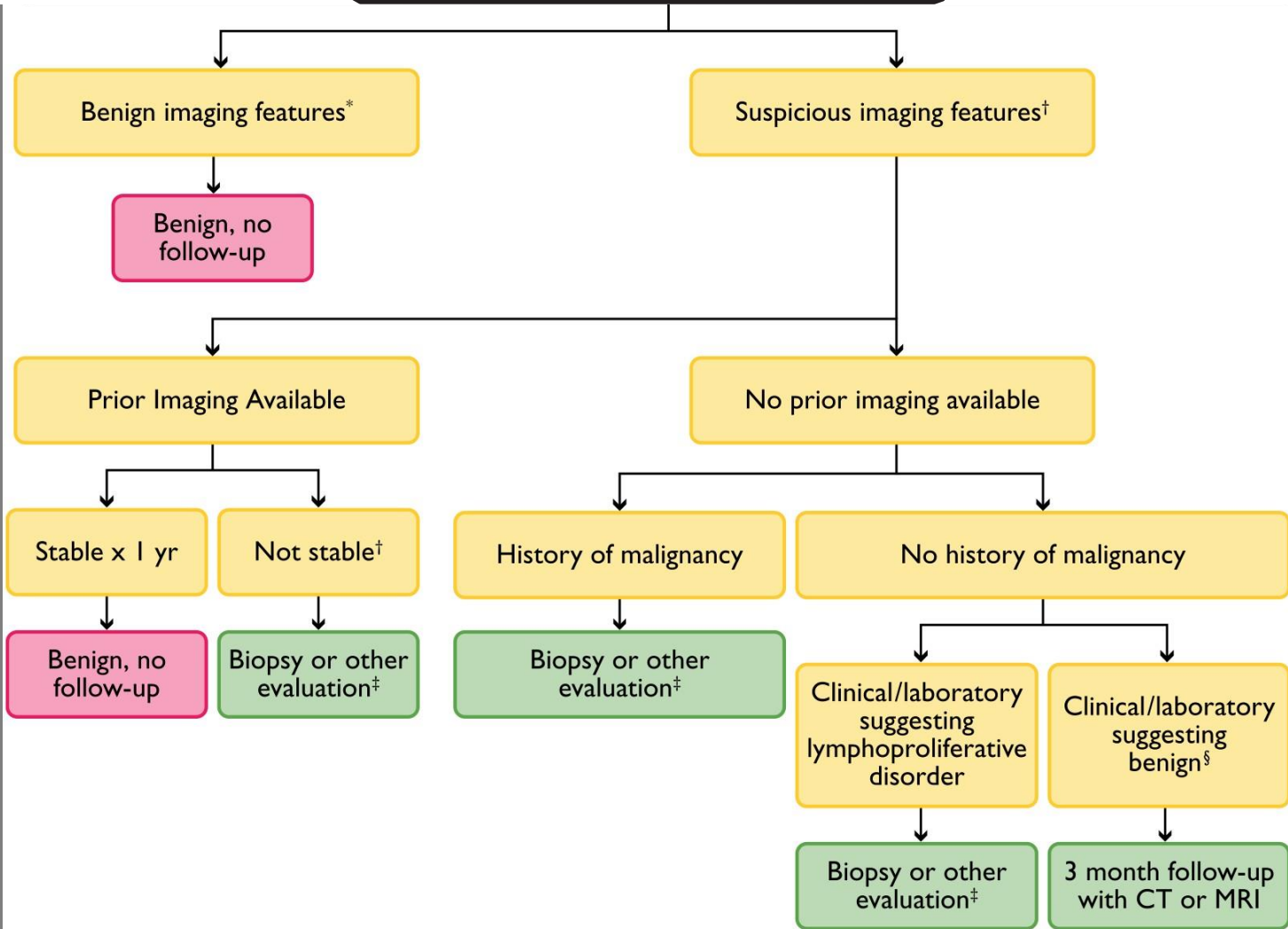
**Atherosclerotic stenosis** commonly affects the celiac, SMA, and IMA. As long as this remains well compensated by collateral vessels and is not symptomatic with postprandial abdominal pain or weight loss, no further evaluation or follow-up is recommended.

The prevalence of **abominal venous thrombosis** on CT was 1.74% in a series of 2619 patients. How to further evaluate venous thrombosis depends on location and the local availability and expertise for particular techniques.

Although incompetence of the ovarian and draining pelvic veins (and resultant venous reflux) are considered the main cause of **pelvic congestion syndrome**, dilated pelvic veins are often seen incidentally in asymptomatic multiparous women. No further imaging or intervention is recommended in asymptomatic women with incidentally discovered dilated pelvic veins.

Both cadaveric and retrospective CT studies from asymptomatic patients suggest that compression of the left common iliac vein by the anteriorly crossing right common iliac artery (an anatomic variant known as **May-Thurner or ilio caval compression syndrome**) is present in approximately 25% of the population, indicating that most patients with compression are not symptomatic, and follow-up is not necessary unless the patient develops unilateral symptoms of leg swelling or thrombosis. Similarly, compression of the left renal vein between the aorta and superior mesenteric artery with localized varices, known as **nutcracker syndrome**, is an occasional asymptomatic incidental finding.

## Incidental Lymph Node Findings on CT or MRI



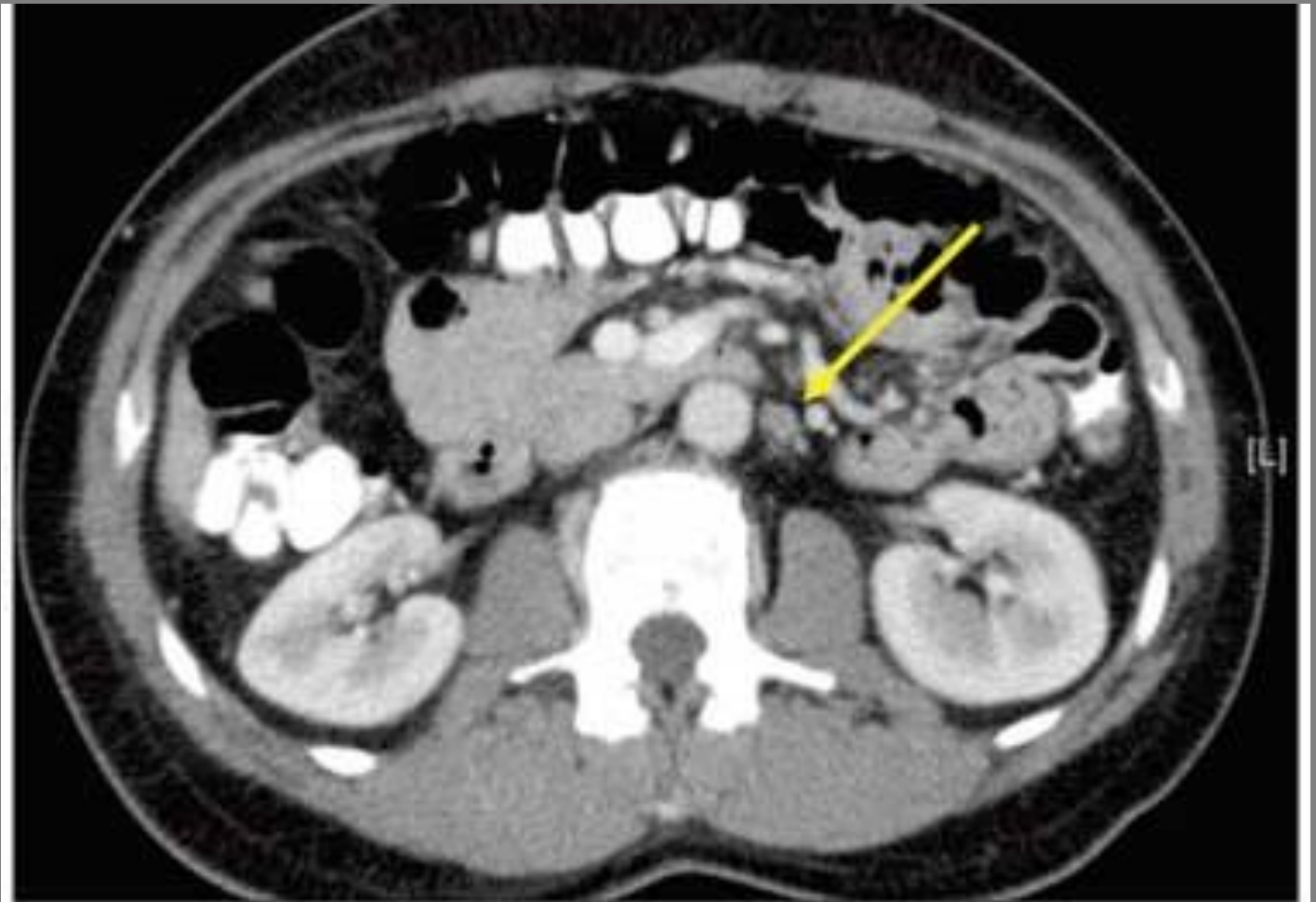
\* **Benign Features:** normal short-axis diameter (<1cm in retroperitoneum), normal architecture (elongated, fatty hilum), normal enhancement, normal node number.

† **Suspicious Features:** enlarged short-axis diameter ( $\geq 1$  cm in retroperitoneum), architectural distortion (round, indistinct hilum), enhancement (necrosis/hypervascular), increased number (cluster of  $\geq 3$  lymph nodes in a single nodal station or cluster of  $\geq 2$  lymph nodes in  $\geq 2$  regions).

‡ **Non-neoplastic Disease:** e.g. infection, inflammation, connective tissue disorders.

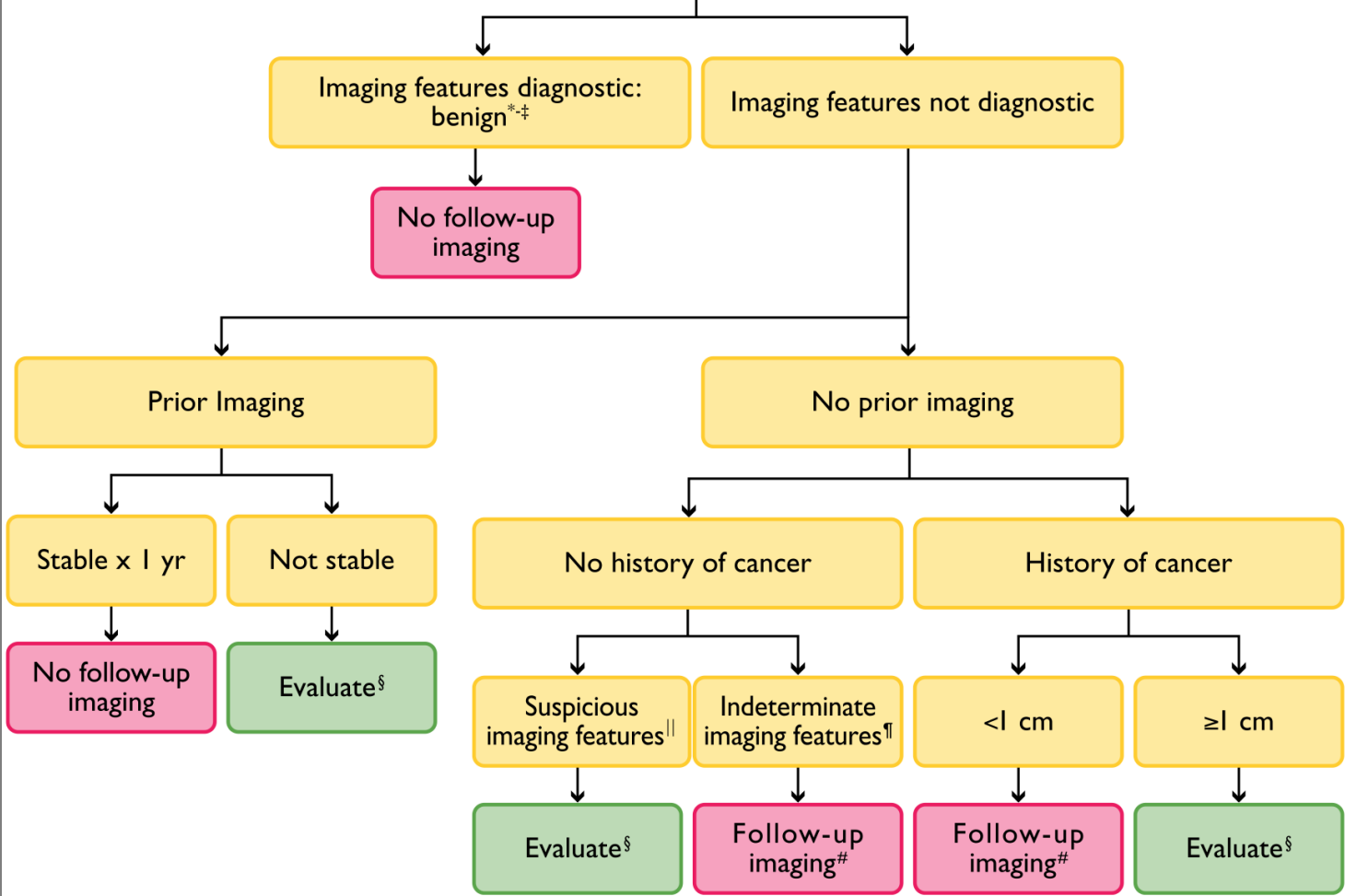
§ **Other Evaluation:** PET/CT, MIBG, endoscopic ultrasound.

## Suspicious Retroperitoneal Node



**Testicular Cancer Metastasis**

## Incidental Splenic Lesion on CT or MRI



\***Cyst:** imperceptible wall, near-water attenuation (<10 HU), no enhancement.

\***Hemangioma:** discontinuous, peripheral, progressively centripetal enhancement (these findings are less common in the spleen compared to the liver).

‡ **Benign features:** homogeneous low attenuation (<20 HU), no enhancement, smooth margins.

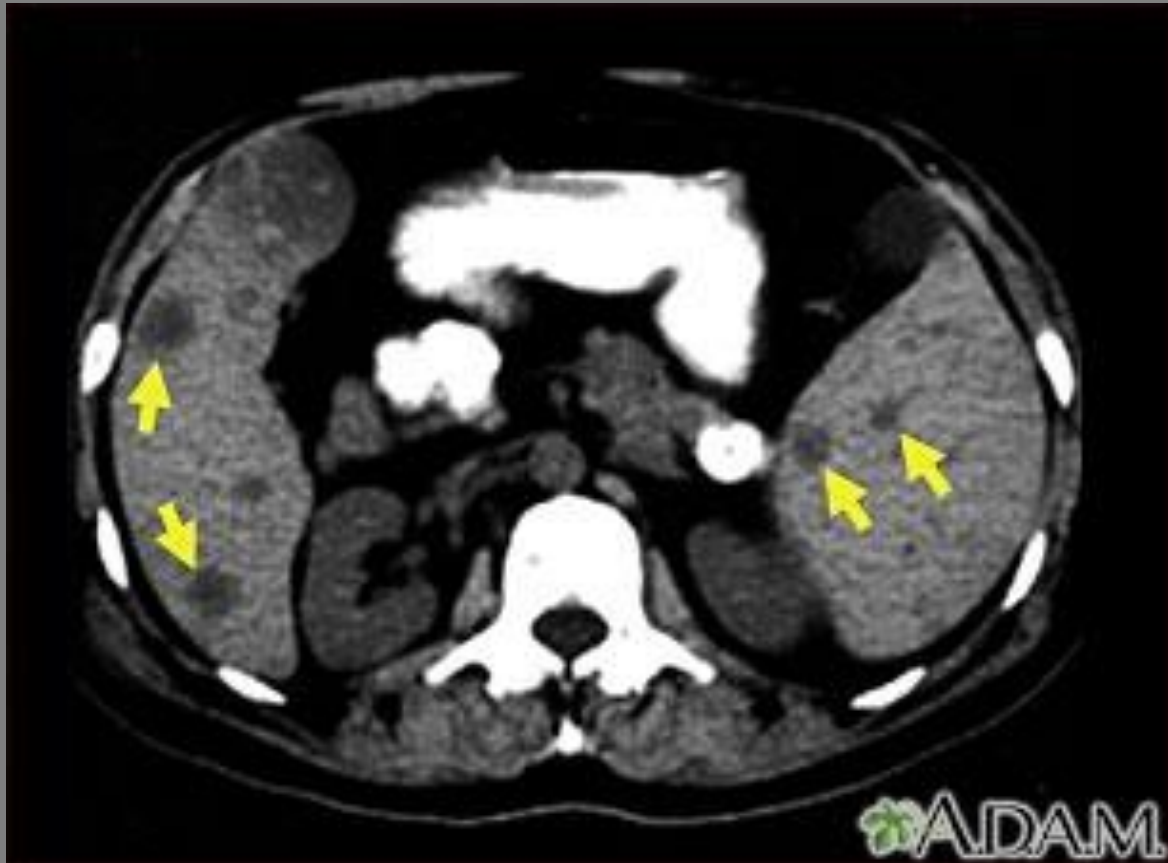
¶ **Indeterminate features:** heterogeneous, intermediate attenuation (>20 HU), enhancement, smooth margins.

|| **Suspicious features:** heterogeneous, enhancement, irregular margins, necrosis, splenic parenchymal or vascular invasion, substantial enlargement.

# **Follow-up:** MRI in 6-12 months.

§ **Evaluate:** PET vs. MRI vs. biopsy.

## Suspicious Splenic Lesions



**GI primary with metastases to spleen**



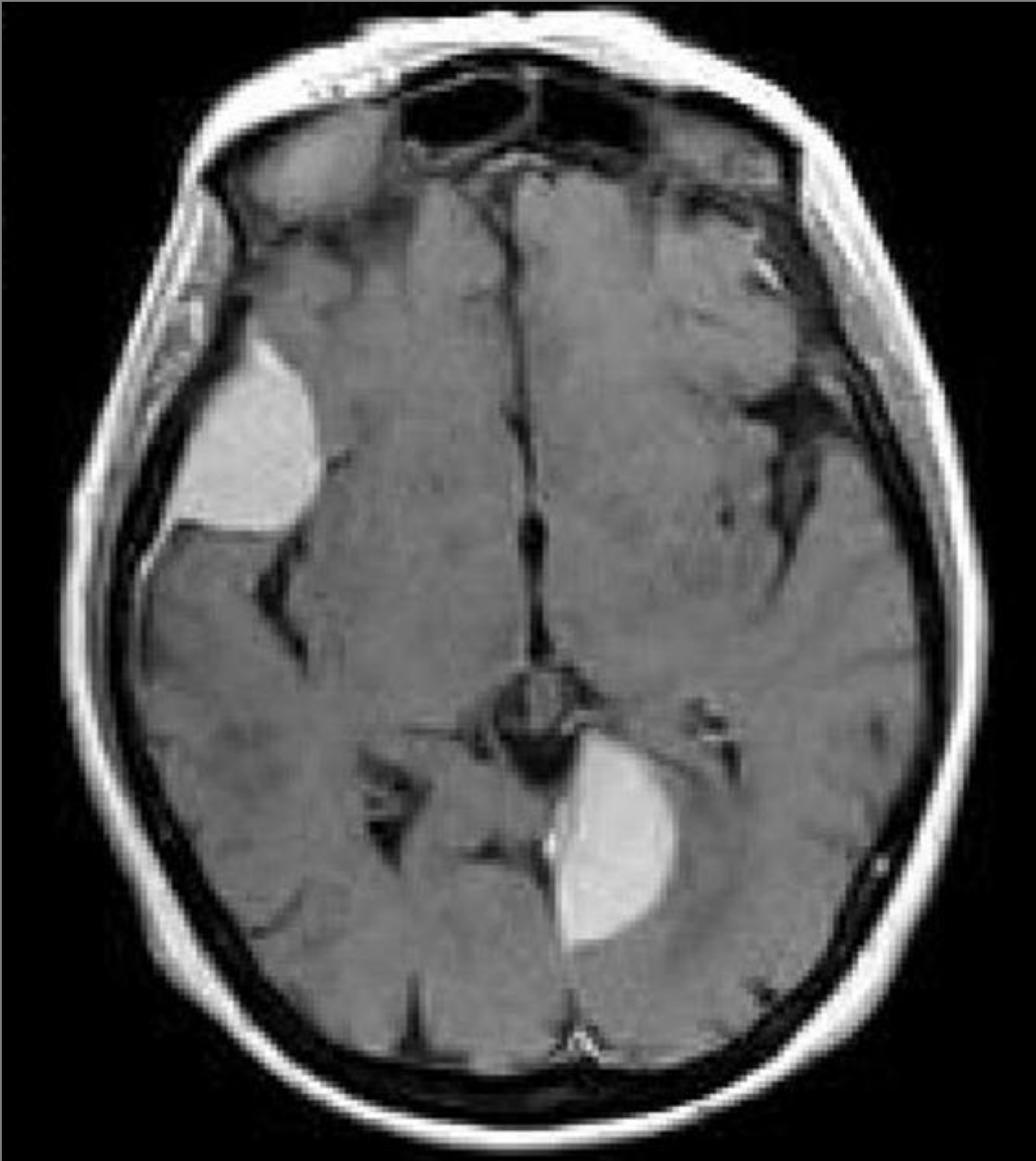
# Pituitary Adenoma



**Endocrine Society practice guidelines recommend:**

- **Macroadenoma – f/u MRI at 6 months, then “progressively less frequently” if stable**
- **Microadenoma – f/u MRI at 1 year, then “progressively less frequently” if stable**

# Meningioma



**British Medical Society practice guidelines recommend:**

- **Follow-up yearly with contrast enhanced MRI for all meningiomas**



# Incidental Gallbladder and Bile Duct Findings

## Summary of Diagnosis and Management in Asymptomatic Patients evaluated by CT or MRI

| Finding  | Finding/Diagnosis  | Action  |
|--|--|---|
| Gallstones, no mass                                      | Gallstones   | If symptomatic, ultrasound  |
| Gallbladder wall calcification, no mass                  | Focal or diffuse (porcelain gallbladder)   | No follow-up recommended; if followed, use post-contrast CT   |
| Dense gallbladder contents (20-100 HU)                   | Sludge, excreted contrast, hemorrhage, gallstones  | No evaluation or follow-up recommended specifically for this finding  |
| Diffuse gallbladder wall thickening > 3mm, no mass       | Hepatitis, CHF, liver disease, pancreatitis, hypoproteinemia                                 | No evaluation or follow-up recommended specifically for this finding  |
| Focal gallbladder wall thickening or mass                | Polyp, gallbladder cancer, cholesterosis, adenomyomatosis, xanthogranulomatous cholecystitis | Evaluation and follow-up depends on mass size, other clinical factors; ultrasound may show specific features for adenomyomatosis (i.e. "comet-tail" artifact) |
| Gallbladder polyp ≤ 6 mm                                 | Benign polyp   | No evaluation or follow-up recommended  |
| Gallbladder polyp 7-9 mm                                 | Benign polyp, adenoma, or small cancer   | Follow yearly with ultrasound; surgical consult if polyp grows  |
| Gallbladder polyp ≥ 10 mm, mass                          | Benign polyp, adenoma, or small cancer   | Surgical consult  |
| Pericholecystic fluid                                    | Gallbladder perforation, other collection  | Individual assessment   |
| Distended gallbladder (> 4cm transverse, > 9cm long)     | Fasting, obstruction   | If asymptomatic, no evaluation  |
| Ductal dilation > 6 mm, or > 10 mm if gallbladder absent | Obstruction, post-cholecystectomy  | If lab results normal, no evaluation; if abnormal, ERCP, EUS, or MRCP as appropriate.   |

### Notes:

**1.Porcelain Gallbladder:** Large retrospective studies have shown that the prevalence of malignancy in resected porcelain gallbladders is 5-7% compared to 0.6 - 0.8% in the general population. Incidence of new cancer in a porcelain gallbladder is likely to be < 1% per year (inferred from available data); only a small fraction of this would likely be detected and treated differently if yearly follow-up were done. Therefore, the committee generally does not recommend follow-up.

**2.Diffuse gallbladder wall thickening:** In the absence of one of the above-mentioned secondary causes, a primary cause should be excluded by clinical history. If the thickening is uniform or nearly so, the risk for an underlying malignancy is negligible.

**3.Polyps:** Evidence for their management is inconclusive and based on ultrasound; the authors infer that this data is also applicable to CT and MRI. One study of 346 patients with gallbladder polyps found no malignancies and only one polyp 7-9 mm in size and two polyps > 10mm. Another study of 467 patients found that only 6.6% of polyps grew, and 3.7% were malignant or had malignant potential, including benign adenomatous and dysplastic potential. Only 0.7% were frankly malignant. The authors recommended follow-up for polyps 5-10 mm in size.

**4.Biliary duct dilatation:** Defined as > 6 mm in a patient < 60 years of age with the gallbladder present, or a common bile duct > 10 mm with the gallbladder absent. Because biliary dilatation is often chronic and asymptomatic, liver function tests (alkaline phosphatase, bilirubin) can help assess the importance of this finding. If there is suspicion of a biliary tract mass, MRCP may be performed. However, if the suspected mass is in the lower third of the common bile duct, endoscopic ultrasound (EUS) or ERCP-guided FNA may be preferred as the first option.

Source: [White Paper: Managing Incidental Findings on Abdominal/Pelvic CT and MRI, Part 4: Gallbladder and Biliary Findings, JACR, December 2013](#)

## Incidental Gallbladder Polyp



**8 mm – follow-up ultrasound when ???**

# *Recap*

1) Management of incidental findings can be confusing and always changing, if you aren't sure when to follow-up call:

x7340

2) No need to follow pulmonary nodules <6 mm (new for 2017)

3) Follow-up recommended for ovarian cysts >3 cm postmenopausal and 5 cm premenopausal

Thank You!!

WOLD FAMILY CENTER FOR EMERGENCY MEDICINE

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**Cell 843-576-9792**

**x3640**

## Management of Adnexal Lesions

newly detected incidentally on US in asymptomatic\* nonpregnant females.

| Cyst Size     | Reproductive Age Female   |
|---------------|---|
| $\leq 3$ cm † | No follow-up. Normal physiology. At your discretion, may not need to be described in the report.                      |
| $> 3$ to 5 cm | No follow-up. Describe in report and include “almost certainly benign”.   |
| $> 5$ to 7 cm | Yearly follow-up. Describe in report and include “almost certainly benign”.   |
| $> 7$ cm      | Further evaluation with MR or surgery should be considered since these may be difficult to assess completely with US. |

| Cyst Size     | Postmenopausal Female †   |
|---------------|---|
| $\leq 1$ cm   | No follow-up. Clinically inconsequential. At your discretion, may not need to be described in the report.   |
| $> 1$ to 7 cm | Describe and include “almost certainly benign” and recommend yearly follow-up, at least initially, with US. |
| $> 7$ cm      | Further imaging with MR or surgery.   |

\* These recommendations may be helpful in **symptomatic** women as well, but the clinical setting will often determine management in a manner beyond the scope of these recommendations.

† **Size:** Use the maximum diameter.

•**Simple Cyst:** A simple cyst is round or oval, anechoic, smooth thin walls, posterior acoustic enhancement, no solid component or septation, and no internal flow. The entire cyst must be visualized. Assess all cysts with color/power Doppler. The rare cyst that turns out to be malignant is usually large ( $> 7$  cm) and the cyst wall was presumably incompletely imaged, with a missed small mural nodule. Over 99% of simple cysts up to 10cm in a patient of any age are benign, either non-neoplastic (physiologic, paraovarian, or paratubal) or benign neoplastic cysts (including serous and mucinous cystadenomas).

Follow-up recommendations for a **hemorrhagic cyst, endometrioma, dermoid, indeterminate lesion, and other lesions**, as well as simple cysts, are presented with example images in the tables on the following three pages.

**Length of follow-up:** No consensus was reached regarding how long a lesion must be followed to demonstrate its stability. Cystic ovarian neoplasms generally grow very slowly.

Source: [Levine et. al. Management of Asymptomatic Ovarian and Other Adnexal Cysts Imaged at US, Society of Radiologists in Ultrasound Consensus Statement, Ultrasound Quarterly 2010;26:121-131.](#)