Management of the The Ground Glass Pulmonary Nodule

References

1. What is a ground glass nodule?
2. What are the distinguishing features of a ground glass nodule?
3. What is the clinical significance of a ground glass nodule?
4. What advice do I impart to referring clinicians about the management of a patient with a ground glass nodule?
HYPERPLASIA

↓

ATYPICAL HYPERPLASIA

↓

DYSPLASIA

↓

CARCINOMA IN SITU

↓

INVASIVE CARCINOMA
Ground glass nodule
3 month followup
71M hx Ca rt lung metastatic to brain. Ca prostate.

CT Number -555H
Lung -860H
Characteristics and Features-GGN

- 1. Small, circumscribed, lesion that occupies a focal portion of the lung parenchyma.
- 2. Low attenuation lesion, mean attenuation typically between -400 and -600H. Mean should not exceed -200H. [Fat = -120H].
- 3. May contain a denser, [usually centrally-located], more solid component.
- 4. Usually invisible on chest xray, especially if < 1cm.
- 5. Ratio long axis/short axis < 1.5. [spherical]
- 6. Slow growth. May show no growth or minimal growth in volume at 6-12 month follow-up.
- 7. Patient asymptomatic.
8. Pure GGN when malignant not associated with LN mets, nor recurrence after surgery.
9. More often malignant than comparable sized solid nodules.
10. GGN due to focal inflammation or bleeding usually disappears or markedly diminishes at 3-4 month FU
11. High likelihood that persistent GGN is malignant; even higher if patient has prior lung cancer.
1. Atypical adenomatous hyperplasia.
2. Bronchioloalveolar carcinoma
3. Adenocarcinoma with features of BAC
   - Nakata 43/43 <2cm were 1,2, or 3. Chest 2002
   - Ohtsuka 34/35 pure ground glass were AAH or BAC Eur J Cardiovasc Surg 2006.
4. Nonspecific focal fibrosis or organizing pneumonia
5. Pulmonary lymphoproliferative disorders
What is the CT# of a GGN?

- Assume lung = -800H
- Assume solid component = +80H
  - If solid portion is 10% of lesion  -712H
  - If solid portion is 20% of lesion  -624H
  - If solid portion is 25% of lesion  -580H
  - If solid portion is 30% of lesion  -536H
  - If solid portion is 40% of lesion  -448H
  - If solid portion is 50% of lesion  -360H
  - If solid portion is 65% not seen as ground glass [-228H]

Feature #2 Mean attenuation lesion should not exceed -200H
236 surgically resected peripheral adenocarcinomas < 2cm

6 types based on tumor growth patterns.

1. Lepidic = replacement growth pattern.
   A. Localized bronchioloalveolar carcinoma
   B. " with foci of alveolar collapse.
   C. " active fibroblastic proliferation

2. Helic = expansile growth pattern - poorer prognosis
Calculated doubling time 7 years
-529H, -130H, and -68H

Adenoca with features of nonmucinous BAC
GGN radiology pathology correlation

- 1. Pure Ground Glass - AAH or BAC
- 2. Mainly ground glass with small solid component – BAC Noguchi B or C.
- 3. Mainly solid with < 50% ground glass. Mainly adenocarcinoma with alveolar cell features.
- 4. Spiculation, pleural retraction, and prominent air-bronchogram not seen with AAH.
- A. GG part, slow growth, solid part, more rapid growth.
- B. Solid part due to alveolar collapse and fibrosis.
- C. The central scar is a desmoplastic reaction to the tumor formed during growth of the tumor.
Decision on the management of GGNs

**OPERATE**

1. Significant solid component
3. Not necessary to do a lobectomy.
4. Aerogenous spread
5. Superb outcome - no LN mets, no recurrences.
6. >2 cm

**DON’T OPERATE**

1. Pure Ground Glass.
2. Overdiagnosis Bias
3. Resecting non-invasive carcinoma.
4. 1/6 of lung carcinomas at autopsy not diagnosed during life and not contributing to death.
5. Patient asymptomatic.
6. <1 cm
57F
Asian
Never smoked.

Focus of invasive carcinoma in background of non-mucinous BAC
1. From the 1950’s to the 1980’s the death rate for lung cancer among Asian women has increased tenfold in Taiwan.
2. Lung cancer the top cancer-killer among women in Hong Kong since the 1960’s and in Japan since 1998.
3. In China 153% increase in lung cancer mortality 1991-2005
5. Cooking oil vapors thought to be an important factor.
Volume Doubling Time =
Elapsed time X log 2 / 3 log [ Dt/Do]
Diameter = [long axis + diameter at right angles to long axis] / 2
Dt = diameter after elapsed time
Do = initial diameter
67M followed for bladder cancer.

CT's 5/24/05-12/21/07

Calculated volume doubling time 20 months.
72F Adenocarcinoma LLL resected 2004, treated for 6 months with chemotherapy.
57 Asian female

Left 9/26/05

Right 5/29/07

0.42 cm x 0.32 cm
Area = 0.11 cm²
Avg = -434.7667 HU
StdDev = 184.1695 HU
Min = -665 HU
Max = 16 HU

0.29 cm x 0.22 cm
Area = 0.05 cm²
Avg = -428.3638 HU
StdDev = 84.0085 HU
Min = -528 HU
Max = -336 HU
Focal scar above, BAC below
Top 06/06

Bottom 2/07

-400H to -607H

Focal scar
Serial studies: 1/05, 7/05, 2/06, 10/06
The epidermal growth factor receptor, EGFR, is a tyrosine kinase. Mutations affecting EGFR expression or activity can result in cancer. IRESSA, [gefitinib], and Tarceva, [erlotinib], are small molecule kinase inhibitors used in treatment of advanced or multifocal BAC. Tissues are tested to determine likelihood of response.
8/07

77F being followed
Mean diameter 2004 = \[ \frac{2.93 + 2.27}{2} \] = 2.6

Mean diameter 2007 = \[ \frac{3.2 + 2.6}{2} \] = 2.9

59F prior history lung ca, lesion is BAC
“The patient is active and well. We continue to follow her lesion that has shown no significant change. She is 75 years old, lives alone and travels the world. She has no family to care for her. A thoracotomy with lung resection would potentially compromise her lifestyle and possibly end her willingness to continue in life. Therefore I have decided to follow this lesion until absolutely forced to do otherwise. We have several patients with biopsy proven BAC who refuse surgery and yet live full lives with no symptoms from their pulmonary process.”
Screen Detection Capability Based on Tumor Biology and Growth Rates

Age-Adjusted Incidence Rates of Breast and Prostate Cancer Over Time and by Prescreen and Postscreen Snapshot

Conclusions GGN

1. The majority of persistent GGN are BAC.
2. Mean attenuation < -200H and typically -400H to -600H.
3. Diff DX: focal fibrosis and organizing pneumonia.
4. Lesions grow slowly – gradually develop central denser areas due to alveolar collapse and fibrosis.
5. Limited surgery: segmentectomy or wedge resection currently acceptable.
6. Predilection for non-smoking Asian women and patients with prior lung ca.
7. 3 month > 6 month > 12 month follow
8. Follow lesions <1cm, remove lesions >2cm.
9. Jury is out on whether surgery is: overtreatment for a non invasive lesion or a prudent measure for a potentially life-threatening neoplasm.