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Tumor Doubling Time of Pulmonary Carcinoid Tumors Measured by CT

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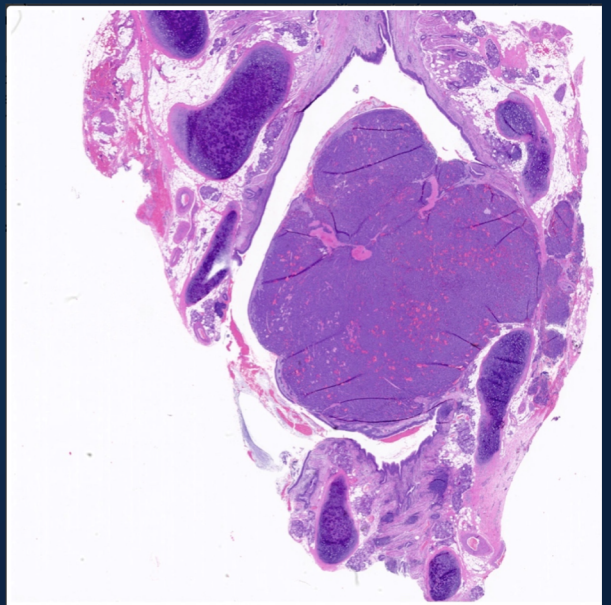
Background

- Pulmonary Carcinoid Tumor (PCT) is a neuroendocrine neoplasm
- 1-2% of all lung cancers
- Typical (low grade) and atypical (intermediate grade) subtypes
- Metastatic, but indolent
  - Clinically known to grow slowly, but limited literature on growth rates
- Often identified as solitary nodules on incidental radiography (e.g. CXR, Chest CT)



Endobronchial pulmonary carcinoid tumor (H&E)

Phillipe Joubert, MD, PhD

Sidney Kimmel Medical College at Thomas Jefferson University

Background

- *What to do once incidental nodule is identified?*

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

A: Solid Nodules*

	Size			
Nodule Type	<6 mm (<100 mm^3)	6–8 mm (100–250 mm^3)	>8 mm (>250 mm^3)	Comments
Single				
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 in low-risk patients (recommendation 1A).

- *If PCT is truly slow-growing, is a 2-year follow up timeframe long enough to detect tumor growth on CT?*

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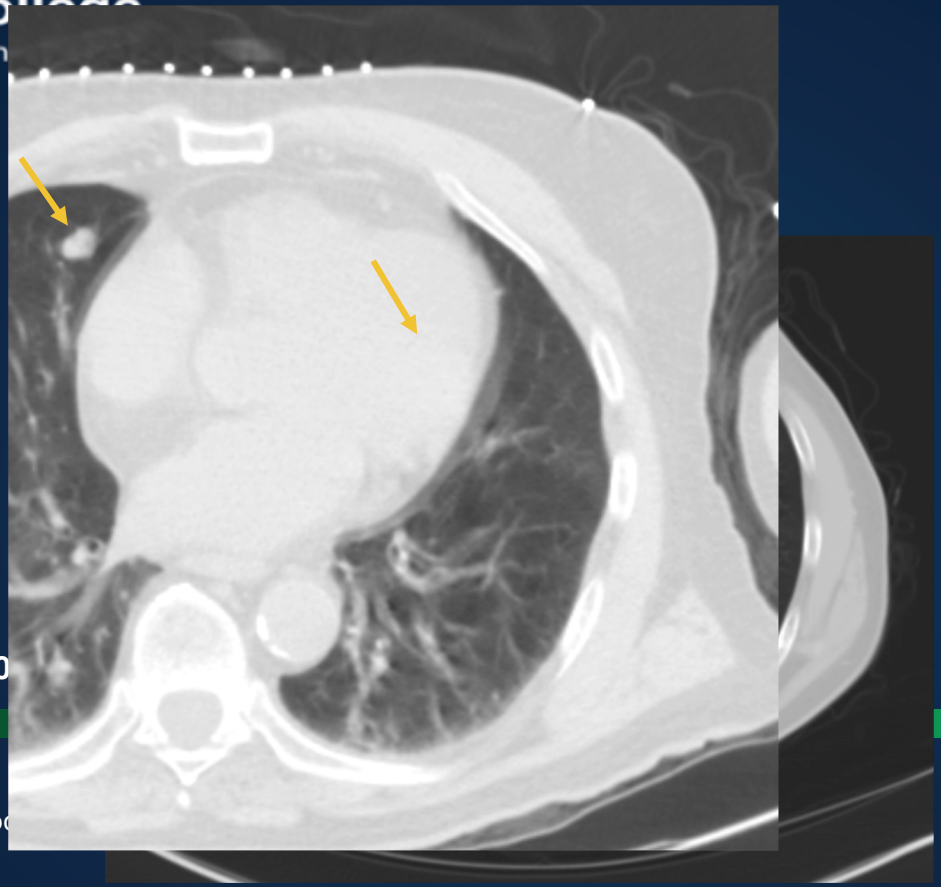

MR, 78 y.o. male

Chest CT for Hx of bronchiectasis → incidental **5 mm peripheral nodule** visible

11-2007

01-200

Repeat CT → noc

09-2017

Percutaneous needle biopsy of nodule now measuring **10 mm**

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Objectives & Hypothesis

- Research Question
  - What is the true growth rate of PCT as measured on CT?
- Hypothesis
  - We hypothesized that PCT would demonstrate a prolonged tumor doubling time compared to other lung neoplasms.

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Approach

- Retrospective medical chart review
- Medical charts (EPIC) & radiographic scans (PACS)
- PCT nodule dimensions measured manually or retrieved from radiology reports
- Inclusion criteria
  - Pathologic diagnosis of PCT
  - ≥ 2 years of radiographic follow up by CT prior to biopsy/resection
  - Tumor demonstrated definitive growth*
- 14/89 patients with pathologically-confirmed PCT met all criteria
- 11 typical carcinoids, 3 atypical carcinoids

*defined as an increase in average nodule diameter ≥ 2 mm[1]

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Results: Tumor Doubling Time

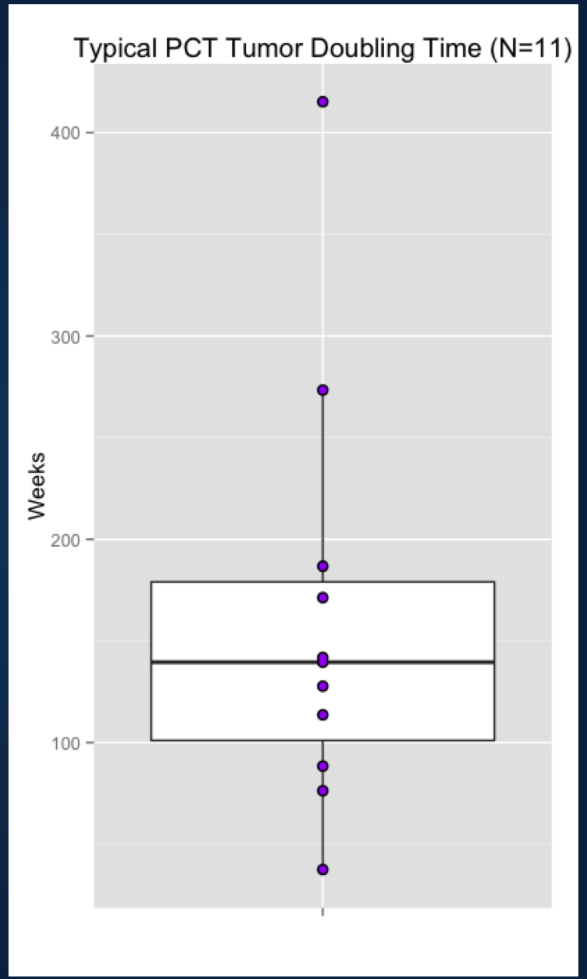
Volume Doubling Time[1] = $[\ln 2 \times \Delta T] / [\ln(V_2/V_1)] = \Delta T / [\log_2(V_2/V_1)]$

Patient MR → **171 weeks**

11 typical PCTs demonstrated definitive growth

Median DT = 140 weeks
Mean DT = 161 ± 105

SCLC[2] → 6 weeks
SCC[2] → 13 weeks
Adenocarcinoma[2] → 20 weeks (solid), 36 weeks (subsolid)



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Conclusions

- The median doubling time of typical PCT was 141 weeks, or almost three years.
- The frequency of atypical carcinoids was too small to form any conclusion about growth rates.
- It is conceivable that typical PCTs detected early with small diameter may be mistaken for benign non-growing lesions when followed for less than two years in low-risk patients.

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Future Directions

- Analysis of larger, prospective cohorts could identify the frequency of PCT and other tumors with prolonged doubling time compared with non-neoplastic lung nodules.

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References

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2. Bankier, et al. “Recommendations for Measuring Pulmonary Nodules at CT: A statement from the Fleischner Society.” November, 2017.
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