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Has PET Imaging Decreased the Rate of Lung Resection for Benign Solitary Pulmonary Nodules?

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Disclosure

- I have no financial obligations or conflicts of interest to disclose

Background

- The widespread use of CT scan has increased detection rates of solitary pulmonary nodules (SPN)
  - Roughly 150,000 new SPN are identified on imaging in the US each year
- SPN represent a diagnostic challenge
  - Diverse differential diagnosis
  - Lung cancer most concerning

Background

- [^{18}F]-fluorodeoxyglucose positron emission tomography (PET) significantly factors into the decision to surgically resect a SPN
  - Widely used in the clinical diagnosis and staging of lung cancer
  - High sensitivity (>90%)
  - Highly variable specificity (40-85%)
  - Prone to false-positives

Objective

Evaluate the ability of PET to:

- Correctly identify benign SPN
  - In patients with suspected early stage non-small cell lung cancer (NSCLC)
  - Who underwent surgery for diagnostic and curative intent

Methods

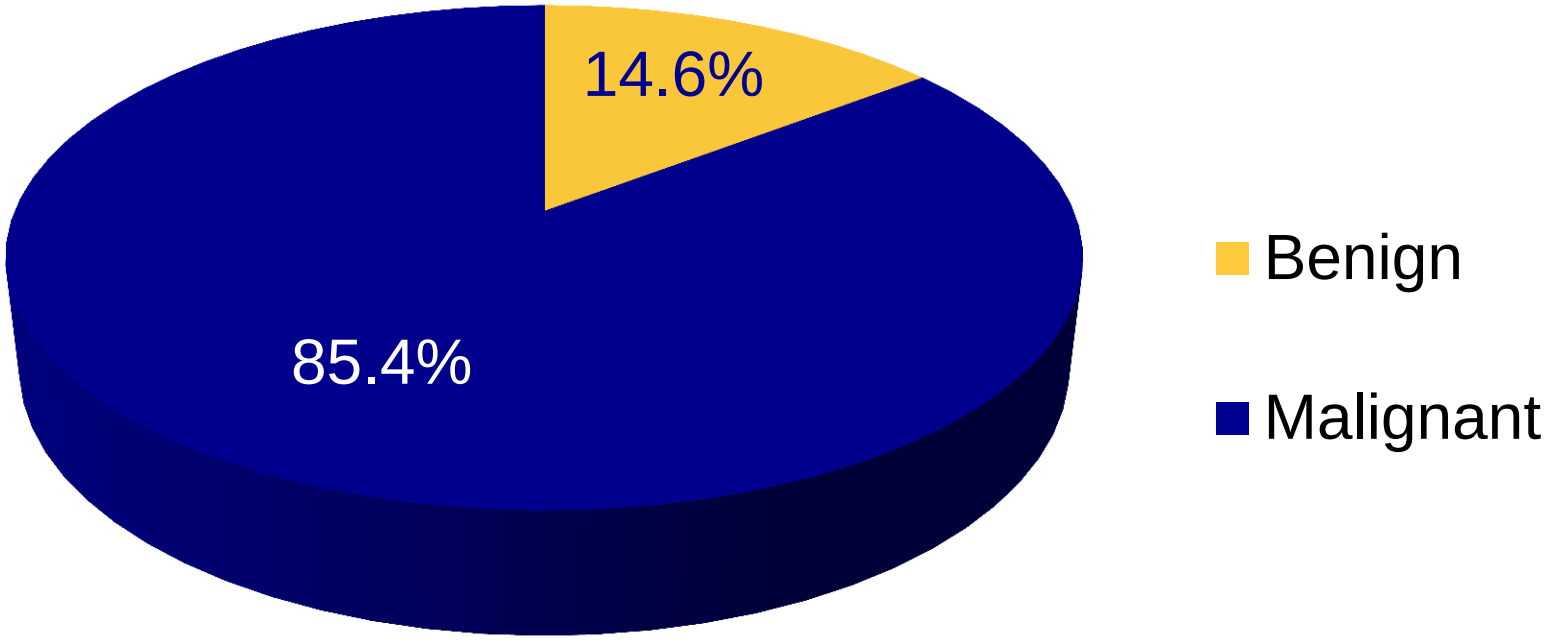
- Retrospective analysis of 402 consecutive patients
  - Enrolled between April 2007 and Sept 2012
  - With a SPN clinically suspicious for early stage NSCLC
- Final study population of 356 patients
  - 28 excluded due to advanced or metastatic disease
  - 18 without PET imaging were also excluded

Methods

- Patient classification: Benign or Malignant
  - Based on final pathological diagnosis
- PET imaging classifications
  - ‘Positive’ – likely malignant
  - ‘Negative’ – not likely malignant
  - Based on radiological description

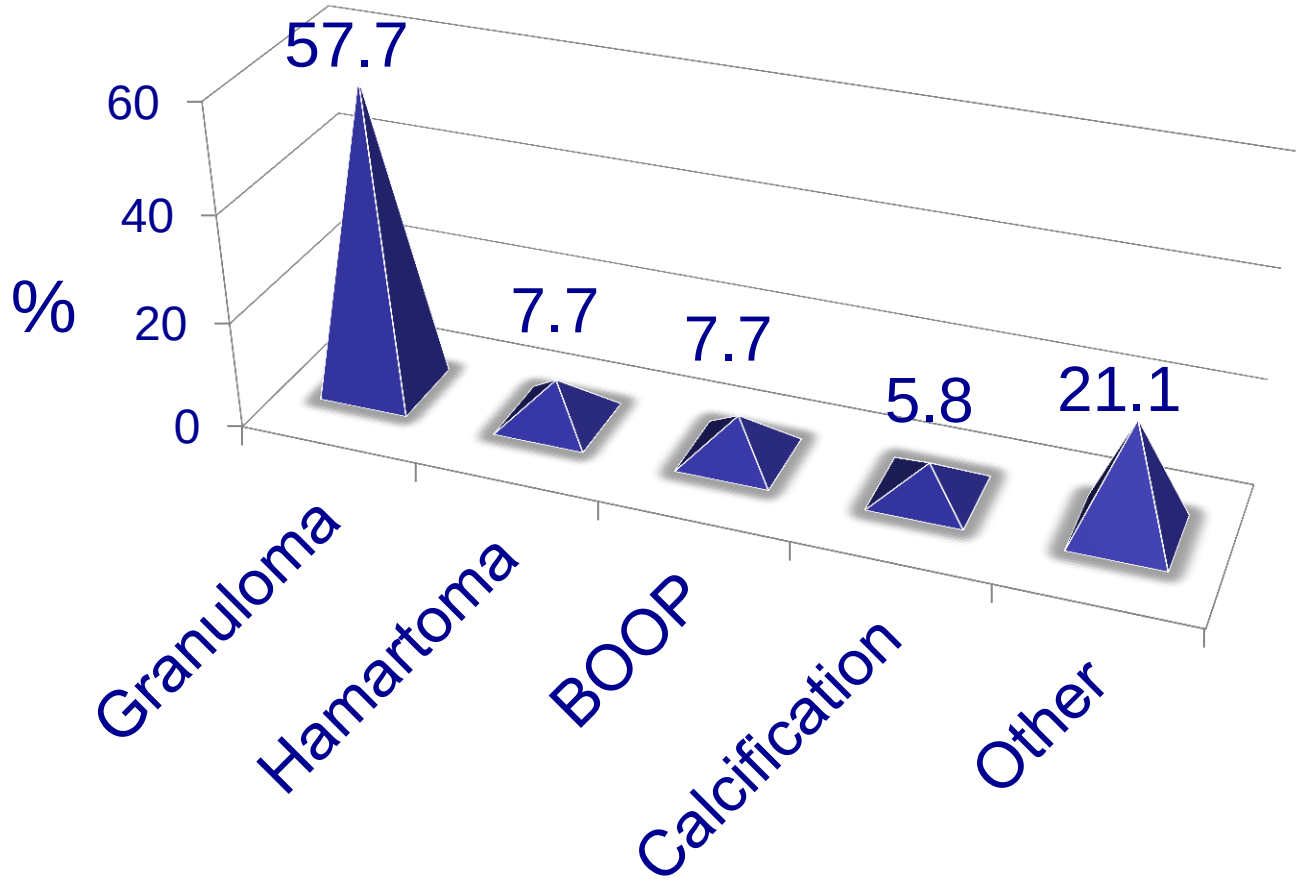
Results

52 Patients with Benign Disease
304 Patients with Malignancy



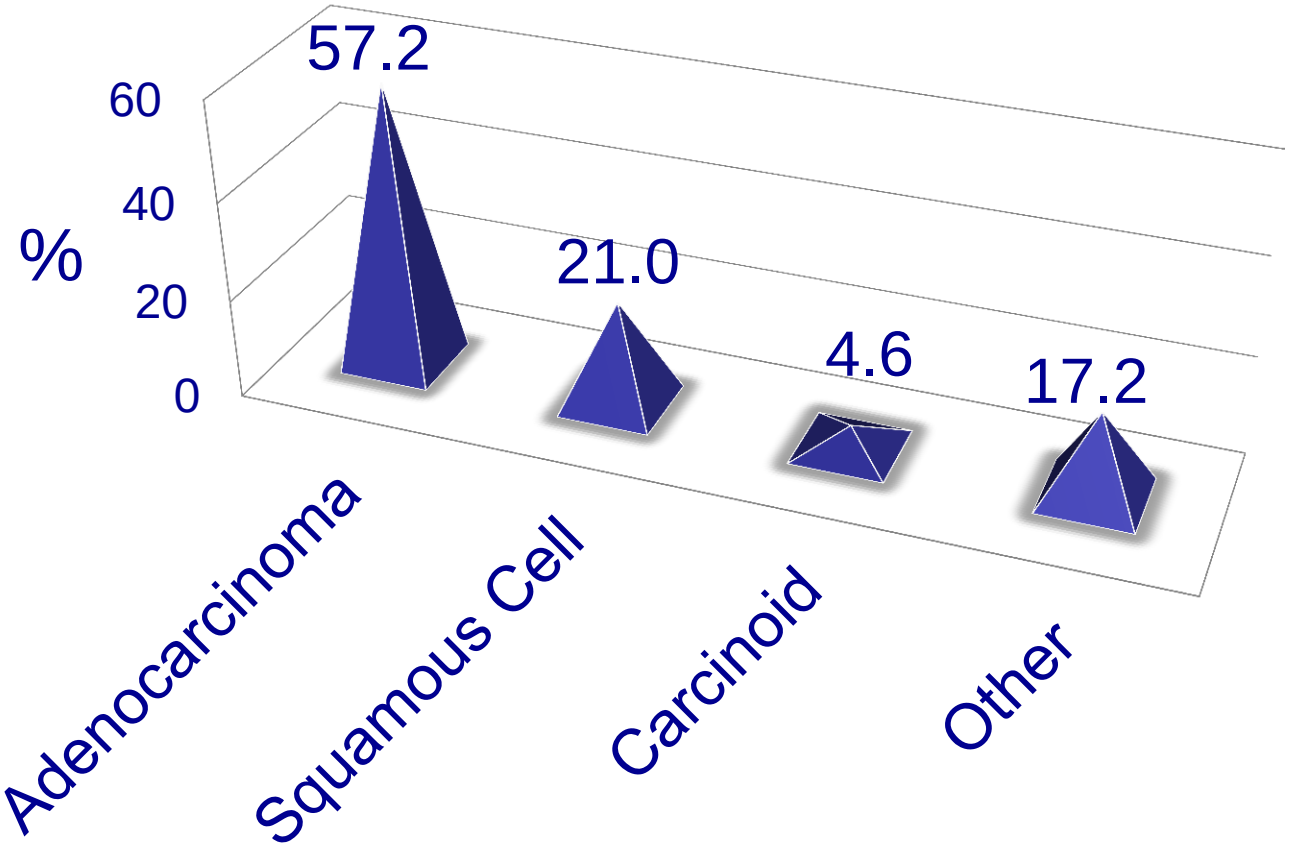
Results

Benign Pathology



Results

Malignant Pathology



Results
Patients Characteristics (N=356)

	Benign 52 (14.6%)		Malignant 304 (85.4%)		
Characteristics	**N**	**%**	**N**	**%**	p value
Median **age**, yrs (IQR)	63 (57 – 70)		67 (60 – 74)		0.011
Gender					0.274
Male	27	51.9	133	43.8	
Female	25	48.1	171	56.2	
Smoking History					0.274
Ever smoked	41	78.8	258	84.9	
Never smoked	11	21.2	46	15.1	
Pack Years (yrs)					0.069
< 20	20	40.0	77	27.3	
≥ 20	30	60.0	205	72.7	

Results
Nodules Size and Imaging Characteristics

	Benign 52 (14.6%)		Malignant 304 (85.4%)		
Characteristic	**N**	**%**	**N**	**%**	p value
Size on CT (cm)					0.002
< 2	30	57.7	113	37.2	
> 2	18	34.6	107	35.2	
Not measured	4	7.7	84	27.6	
PET Positive Adenopathy					0.254
Hilar	4	7.7	29	9.5	
Mediastinal	8	15.4	21	6.9	
Both	2	3.8	13	4.3	
None	38	73.1	241	79.3	
Size on Pathology (cm)					<0.001
< 2	37	74.0	140	46.0	
> 2	13	26.0	164	54.0	

Results

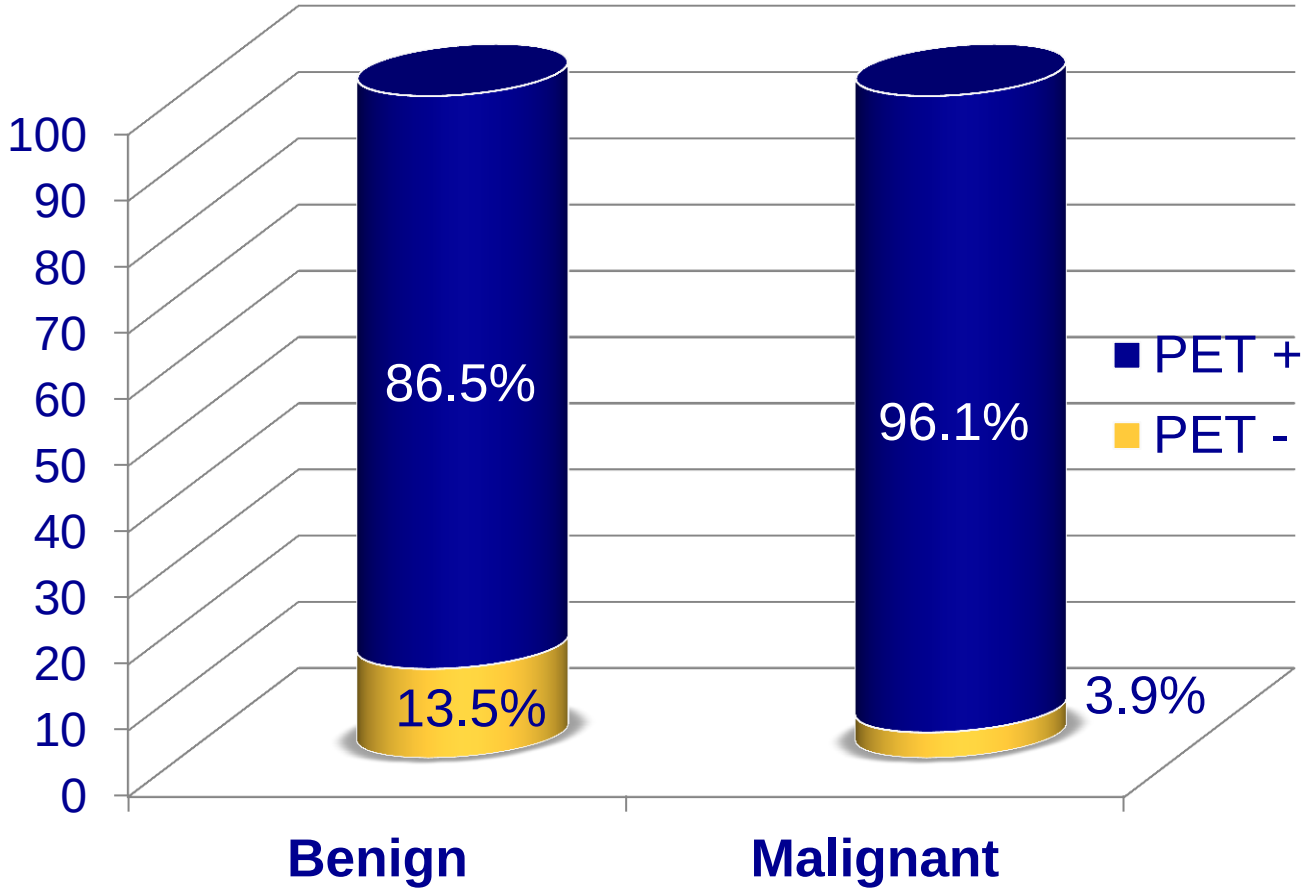
Perioperative Characteristics of Benign Nodules

	N	%
Surgery type		
Wedge	28	53.8
Lobectomy	23	44.3
Bilobectomy	1	1.9
Surgery Access		
Thoracotomy	24	46.2
VATS	28	53.8
Lymphadenectomy		
Yes	25	48.1
No	27	51.9
Length of stay (median-IQR)	4 days	(3-5)

Results
Perioperative Characteristics

	N	%
Complications		
Mortality	0	0
Overall morbidity	12	23.1
Complication Types		
Cardiac arrhythmias	4	7.7
Prolonged air leaks	2	3.8
Pulmonary embolism	1	1.9
Respiratory failure	2	3.8
Pneumonia	1	1.9
Bleeding	1	1.9
Urinary retention	3	5.8
Urinary tract infection	1	1.9
Reoperation	1	1.9

Results
PET Performance



Sensitivity: 96.1%
Specificity: 13.5%

PLR: 1.1
NLR: 0.2

Limitations

- Retrospective Nature
- Selection Bias
- PET Verification Bias
  - PET subjectivity
  - Lack of standardization amongst radiologists
    - 65% with PET imaging had no SUV_{max} reported
  - Variability amongst PET performance centers
    - 51% patients with PET imaging from other facilities

Conclusions

- Surgeons must be aware of the limitations of PET in diagnosing lung cancer
- PET has high sensitivity but poor specificity
- In high risk populations it's difficult to ignore any SPN with increased tracer uptake
- PET alone should not be the sole factor in the decision to resect a pulmonary nodule

Conclusions

- A positive or negative PET scan should be interpreted in the context of each patient
- Resection of benign disease is inevitable at this time
- More non-invasive methods are needed to aid in diagnosing lung cancer

Thank You for Your Time and Attention