

Solitary Pulmonary Nodule (SPN) by Dr Marie Talty & Dr Oisín O’Connell, Bon Secours Hospital Cork

Definition of Solitary Pulmonary Nodule (SPN): A discrete nodule <3cm completely surrounded by lung parenchyma, measured volumetrically or the average of the long and short axis rounded to nearest mm

Prevalence: ~20% of CT scans with incidental pulmonary nodules (SPN incidence 39% over 3 yrs in NSLT Trial)

Differential: Infectious/Inflammatory/Scar/Artefactual/ Vascular/ Developmental/Malignant

Nodule types: Solid/Subsolid/Ground-glass

SPN Volumetric Doubling time:

- Fast growing nodules ~40days
- Slow growing nodules ~400days

Delineate cancer risk of high risk SPN using a prediction model (recommended calculators available on ‘HospitalBuddy’ app) designed for study population relevant to how your nodule was detected.

Eg for CT only detected SPN can use:

VA model 2007, PKUPH Model 2012, Brock PanCan Model 2013

SPN prediction models that incorporate a **PET scan** in risk assessment: Herder model 2005, TREAT model 2014, BIMC model 2015

ACCP SPN guidelines one use most relevant patient cohort calculator eg **Mayo Clinic model** or **Herder model** or **BIMC model** or **Brock model** BTS guidelines recommend **Brock model** and classify low risk for early CT surveillance if under 10% predicted risk malignancy

Mayo Clinic Model:

<https://reference.medscape.com/calculator/solitary-pulmonary-nodule-risk>

Brock Model Link (only model including Sub-solid nodules)

<https://www.brit-thoracic.org.uk/quality-improvement/guidelines/pulmonary-nodules/pn-risk-calculator/>

Herder Model with or without a PET scan:

http://www.nucmed.com/nucmed/spn_risk_calculator.aspx

BIMC Model (Bayesian Inference malignancy Calculator PET, can incorporate for nodule growth rate)

<http://www.simoneperandini.com/bimc/>

All Main Calculators for comparison:

<https://www.sts.org/resources/lung-nodule-resources/lung-nodule-risk-calculators>

Case Study of Predicted risk of SPN malignancy under various sizes:

65 yr male, RUL nodule, no fam hx ca, former smoker, emphysema, no hx ca, single non-spiculated SPN risk by size (mm):

Table 1: Predicted risk lung cancer in various size SPN based on case above

SPN size (mm)	Brock Model	Herder Model No Pet done	Herder Model Pet with no uptake	Herder Model Faint Pet	Herder Model High Pet
3mm	0.1%	4.3%	1.0%	9.5%	54.7%
5mm	1.0%	5.4%	1.1%	9.8%	55.8%
7mm	3.2%	6.9%	1.1%	10.3%	57.1%
9mm	6.5%	8.7%	1.2%	11%	58.8%
11mm	10.7%	11%	1.3%	11.8%	60.8%
13mm	15.3%	13.7%	1.4%	12.9%	63.2%

ACCP <5% BTS <10%

- ACCP suggest close CT surveillance eg with Fleischner guidelines when initial predicted SPN cancer risk is <5%
- BTS suggest close CT surveillance eg 3-12mths when predicted risk <10%
- Fleischner 2017 <6mm SPN recommends consider 12mth CT surveillance in “Upper Lobe” SPN even in low risk population category

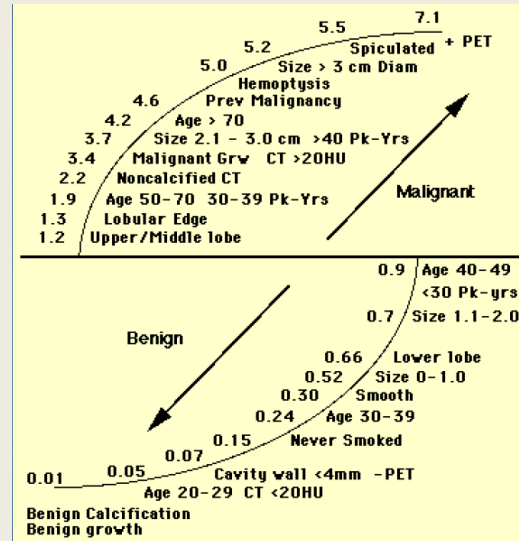
When the calculated predicted SPN risk is ACCP 5-65% or BTS 10-70%:

- Further risk stratification & testing needed eg. PET +/- CT biopsy
- Patient led discussion on the risks and diagnostic uncertainty

ACCP >65% BTS >70%

CT guided TTNA biopsy may help to decide, but CT TTNA miss 10% of lung cancers in this risk grp so definitive surgical excision biopsy or definitive other therapy should be done if predicted risk of cancer >65% per ACCP or >70% per BTS

- if CT TTNA proven lung ca → direct to lobectomy & lymphadenectomy
- if CT TTNA negative → consider diagnostic excision biopsy by VATS resection & fresh frozen section or other definitive cancer therapy eg SBRT/Radiofrequency ablation (RFA).



Future directions:

“Integrated classifier” eg the Pulmonary Nodule Plasma Proteomic Classifier (PANOPTIC) trial using clinical risk factors and proteomics risks to quantify nodule risks more accurate than CT.

Artificial intelligence based radiology risk identifiers eg www.Optellum.com or Radiomics

“Field of Injury” genomic classifier risk stratification eg Veracyte

Exhaled condensate Breath Diagnostics OneBreath micro-reactor technology (PMID: [25965541](https://pubmed.ncbi.nlm.nih.gov/25965541/))

Patient Education & Information for SPN:

Patients should be given a copy of the Irish Thoracic Society SPN Patient Information leaflet:

<https://www.irishthoracicsociety.com/wp-content/uploads/2021/03/Pulmonary-Leaflet-ITS-Nov-2019-1-1.pdf>

References

PMID: [23649456](https://pubmed.ncbi.nlm.nih.gov/23649456/) PMID: [28240562](https://pubmed.ncbi.nlm.nih.gov/28240562/) PMID: [30272500](https://pubmed.ncbi.nlm.nih.gov/30272500/)

