A Classic Reborn –

Cone Beam CT / Fluoroscopic-guided Biopsy Hastened the Diagnosis of Lung Cancer significantly

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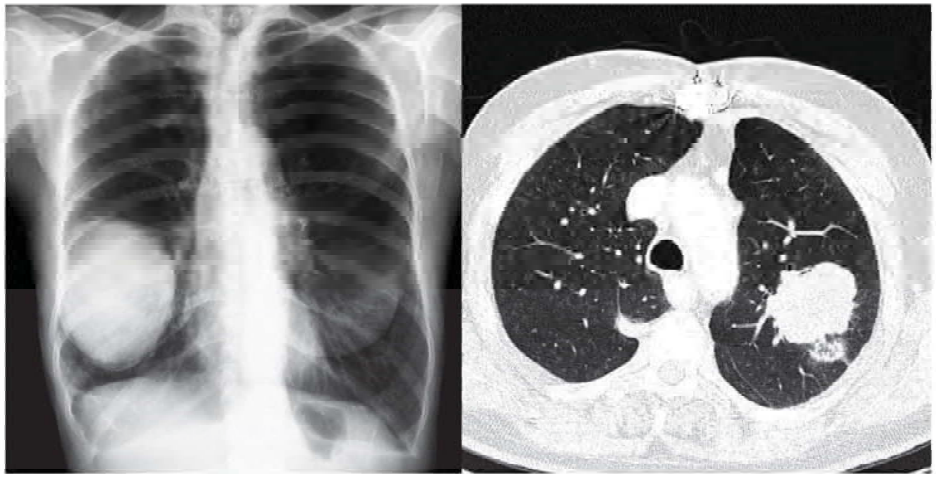
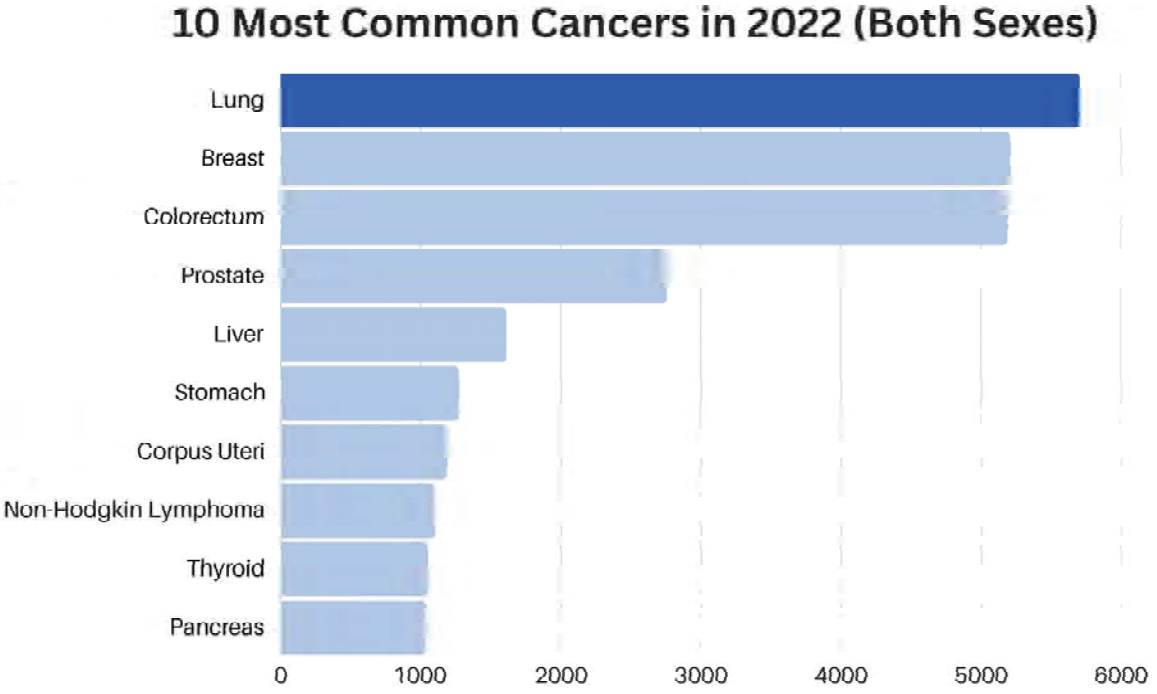
Lung Cancer in HK

- **Most common cancer** in HK
  - 5707 new cases in 2022 (16.1%)
- **First leading cause of cancer deaths**
  - 3880 deaths in 2023 (26.1%)





Census and Statistics Department, Department of Health.

Imaged-guided Lung Biopsy

- Importance of **histological subtype** and **molecular testing** for lung cancer
- Bronchoscopic lung biopsy vs **Image-guided percutaneous lung biopsy**

Conventional CT-guided lung biopsy

- Safe and accurate ✓
- Compete for CT slots, **delay diagnostic service** ✗
- **Long patient waiting time** ✗

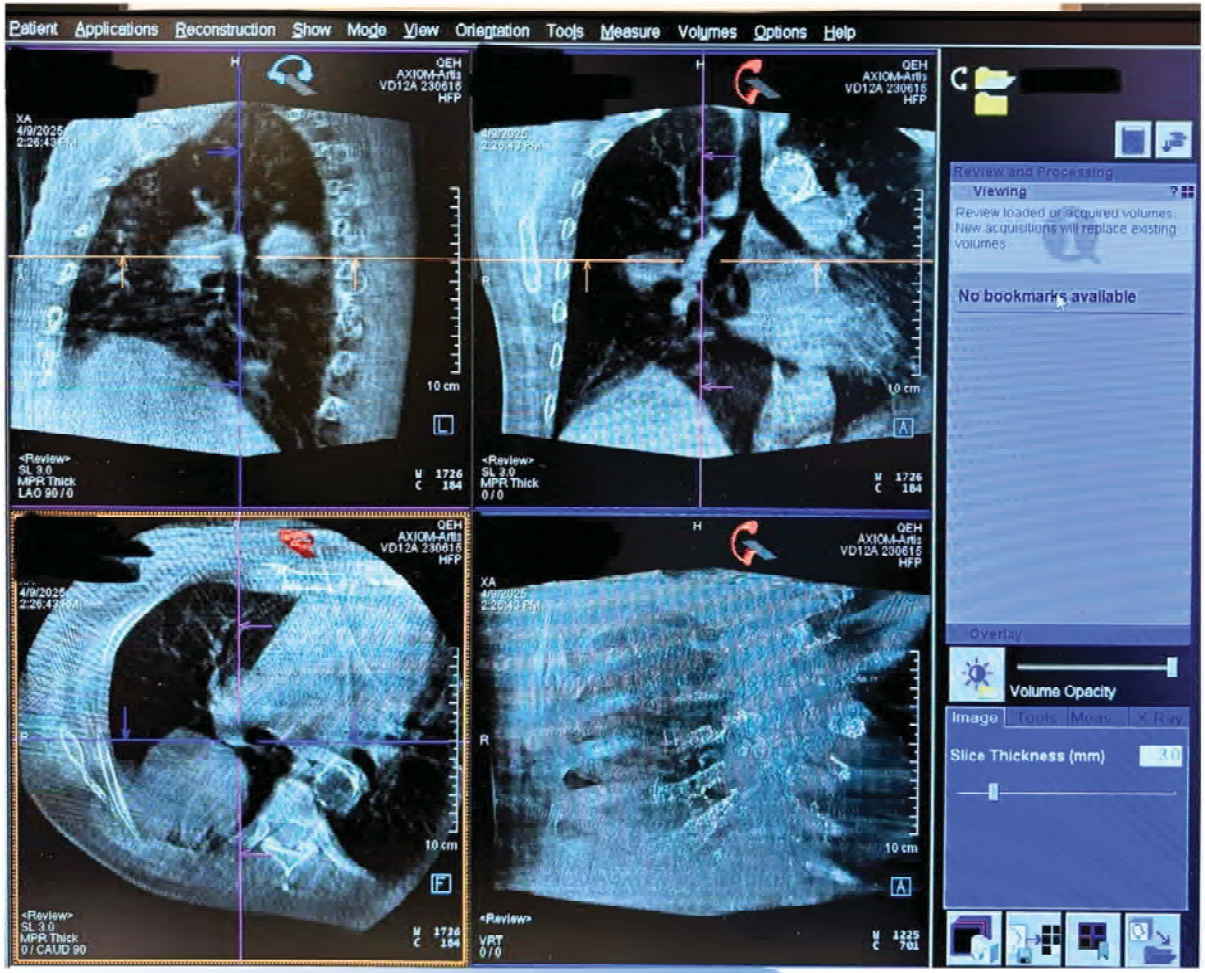
Cone Beam CT / Fluoroscopy-guided Lung Biopsy

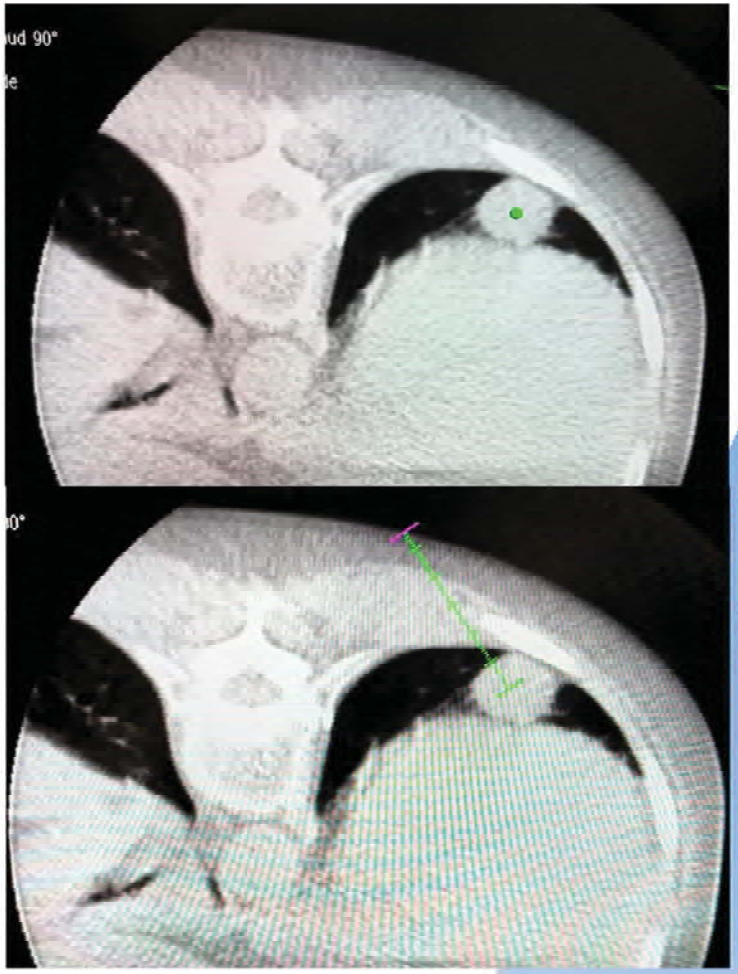
- Fluoroscopic-guided biopsy routinely performed before the advent of CT-guided procedures
- Modern angiography system and fluoroscopic machines have **in-built cone beam CT system**

3-D reconstructed CT images + real-time fluoroscopy capability

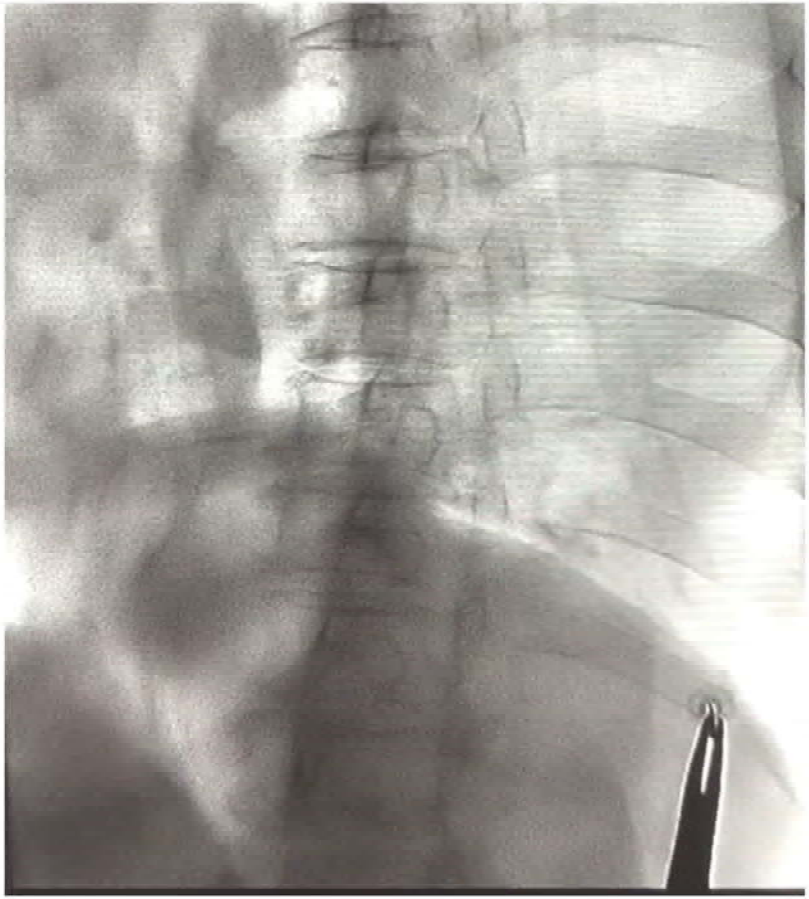
Cone Beam CT acquisition

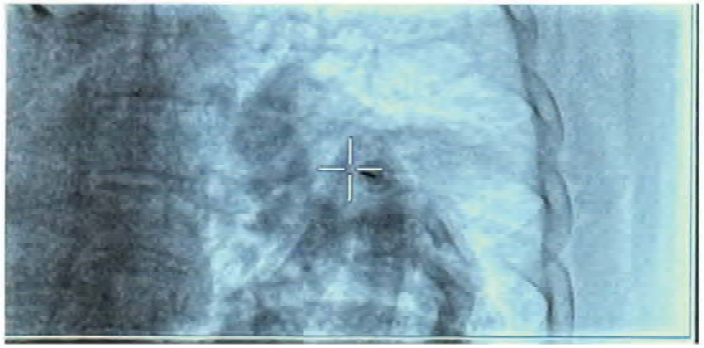
Multi-planar planning for Needle Trajectory

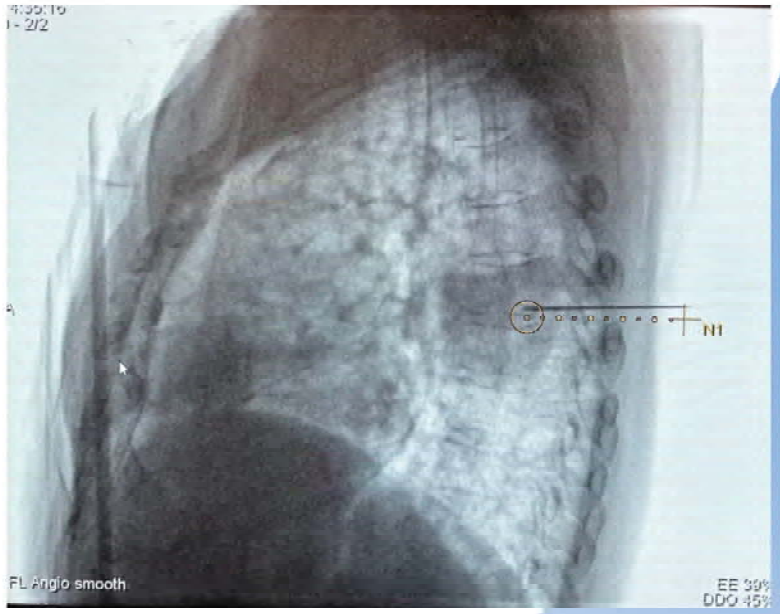




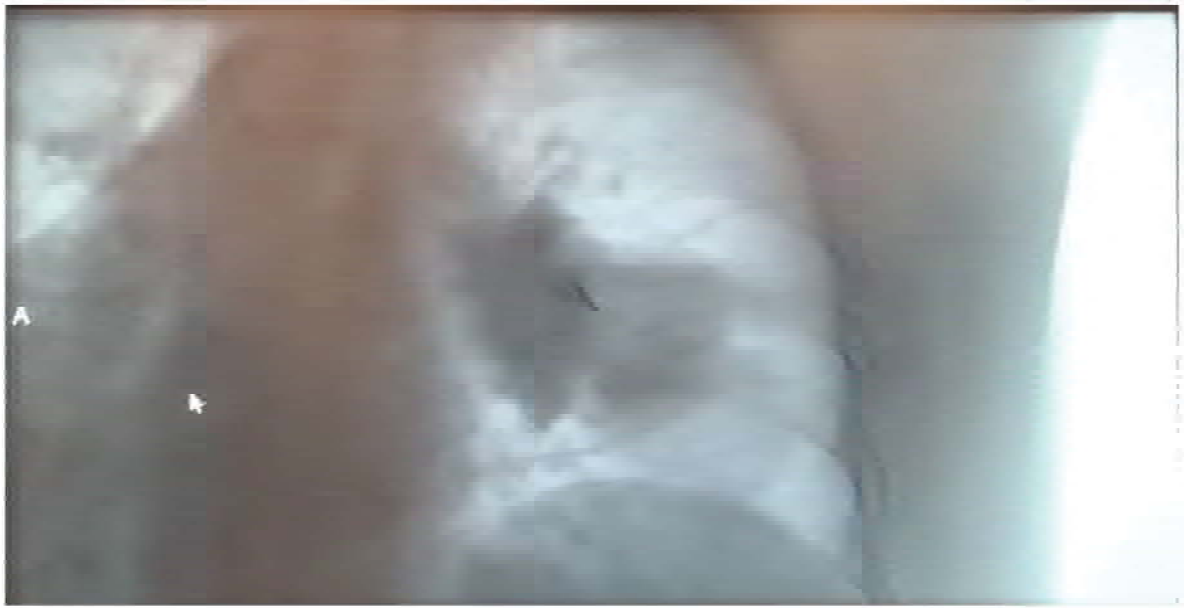
Real-Time Fluoroscopy-guided Needle Placement

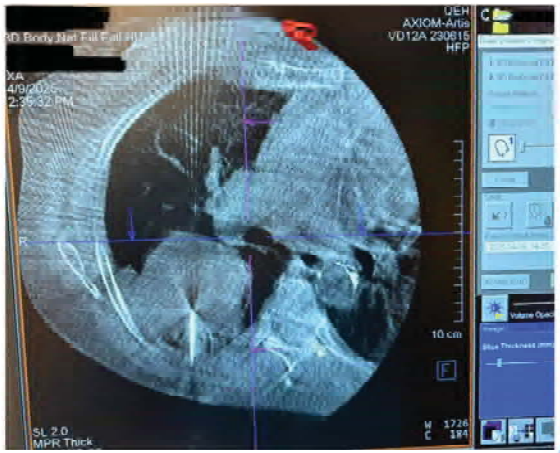






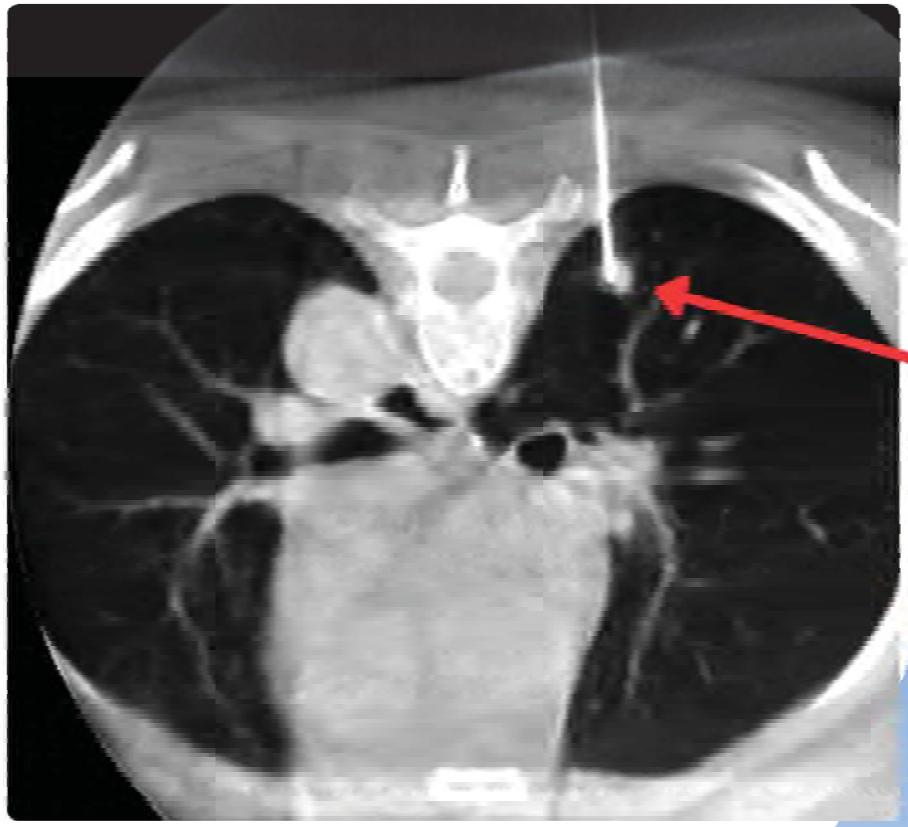
Immediate Confirmation of Needle Placement with CBCT





Cone Beam CT / Fluoroscopy-guided Lung Biopsy – Advantages

- Real time guidance
- Accurate needle localization
- Flexible biopsy approach
- Short learning curve
- Lower radiation dose



Lower radiation dose

Patient dose comparison study

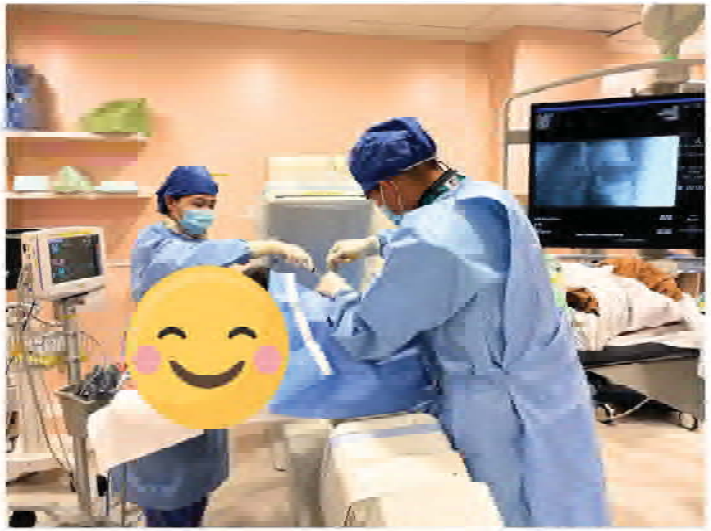
- Phantom under irradiation with different settings:
  a. Fluoroscopy PA tube position + Supine patient
  b. Cone Beam CT with Supine patient
  c. CT with Supine patient

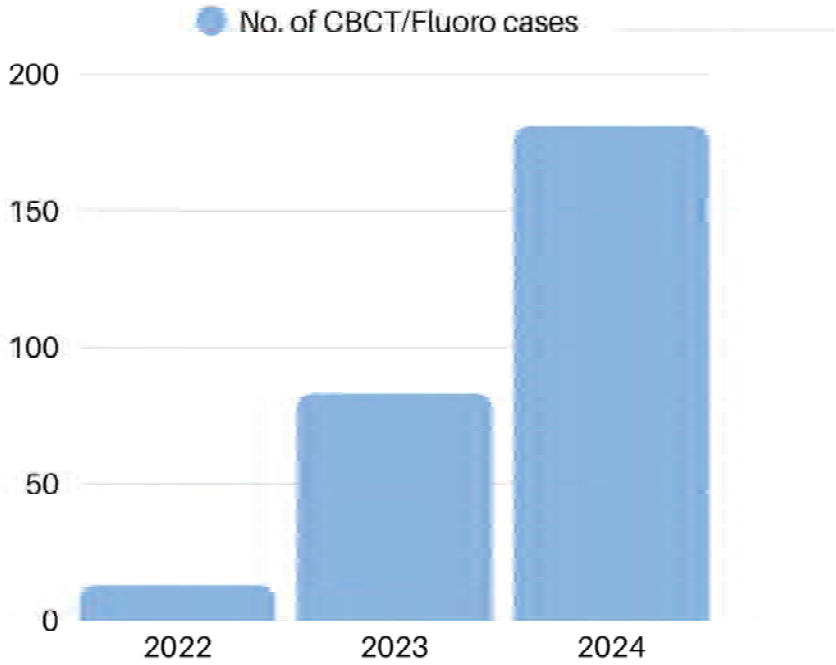
	CBCT + Fluoroscopy	CT
Estimated effective dose (mSv)	**1.67**	3.58

>50% dose reduction to patient

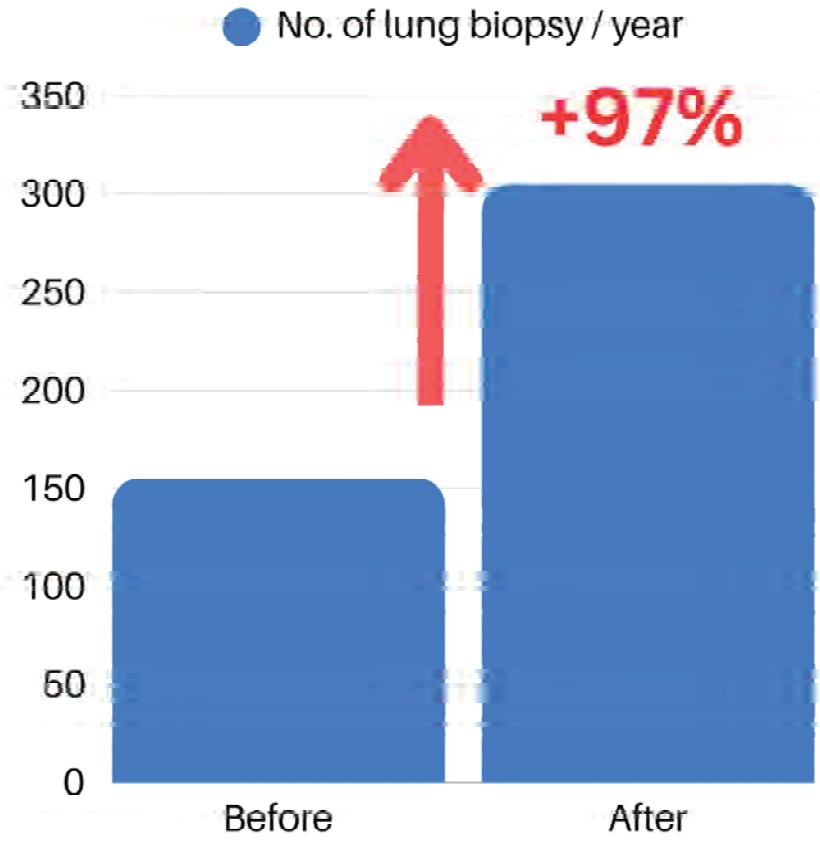
Lung Biopsy Service in QEH

- Total **764** lung biopsies from Jan 2022 to Nov 2024
- CBCT / Fluoroscopy-guided lung biopsy service commenced in **Nov 2022**
  - **277** cases up till Nov 2024





Lung Biopsy Service in QEH

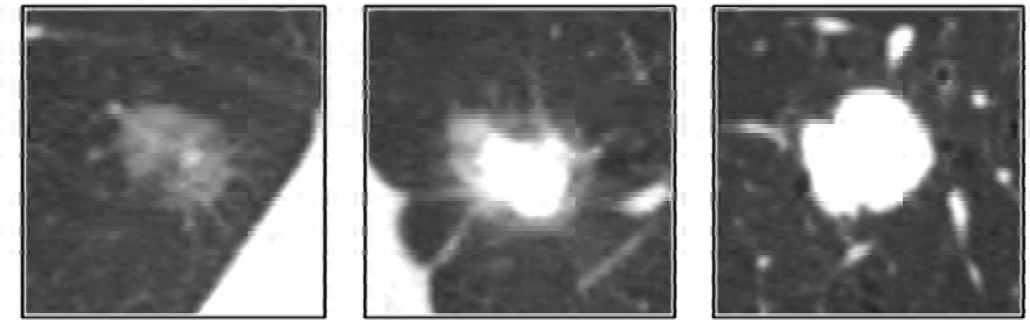


Doubled Total Capacity

- Before: 155 cases / year
- After: **305** cases / year

Demographics

- **84%** are **solid or part-solid** lesions **≥1.5cm**



Patient and Lesion Characteristics (N = 277)

Characteristic	Value
Age (years)	
31–40	3 (1.1)
41–50	4 (1.4)
51–60	29 (10.5)
61–70	103 (37.2)
71–80	105 (37.9)
81–90	29 (10.5)
>90	4 (1.4)
Gender	
Male	155 (56.0)
Female	122 (44.0)
Smoking Status	
Current/Ex-smoker	125 (45.1)
Never smoker	152 (54.9)
Lesion Type	
Solid	212 (76.5)
Part-solid	57 (20.6)
GGO	8 (2.9)
Lesion Location	
RUL	80 (28.9)
LUL	61 (22.0)
RLL	60 (21.7)
LLL	56 (20.2)
RML	20 (7.2)
Lesion Size (cm)	2.6 [1.9]*

* Median [interquartile range]
All other values represent n (%)
Abbreviations: RUL = right upper lobe; LUL = left upper lobe; RLL = right lower lobe; LLL = left lower lobe; RML = right middle lobe; GGO = ground-glass opacity

High Diagnostic Yield

For solid and part-solid lesions >=1.5cm

	CBCT/Fluoroscopy-guided biopsy (N=233)	**CT-guided biopsy** (N=219)	P-value
Diagnostic yield	226 (**97.0%**)	214 (**97.7%**)	p=0.63

- **67%** malignant
- Majority (**69%**) are **adenocarcinoma**

Low Complication Rate

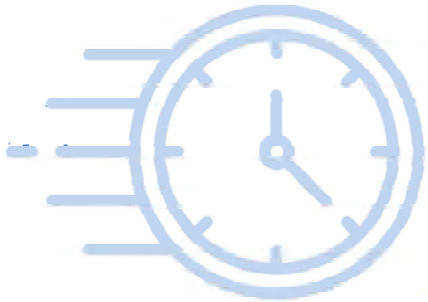
For solid and part-solid lesions >=1.5cm

	CBCT/Fluoroscopy-guided biopsy (N=233)	CT-guided biopsy (N=219)	P-value
Pneumothorax requiring chest drain insertion	**9** (3.9%)	**11** (5.0%)	p=0.55
Hemoptysis requiring intervention	**0** (0%)	**3** (1.4%) • 2 cases of massive haemoptysis requiring bronchoscopic clot evacuation • 1 case requiring chest drain insertion	/
Other complications	• 1 case of hemothorax with Hb drop requiring chest drain insertion and early lobectomy	/	/

Similar Procedure Time

For solid and part-solid lesions >=1.5cm

	CBCT/Fluoroscopy-guided biopsy (N=233)	CT-guided biopsy (N=219)
Median procedure time (Mins)	21	21

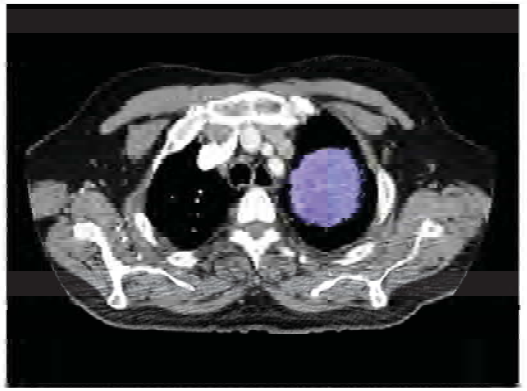


伊利沙伯醫院
QUEEN ELIZABETH HOSPITAL

Service Improvement in QEH

Increased capacity

Before: 155 cases / year
After: 305 cases / year



More diagnostic CT scans

Equivalent to **600** non-contrast CT scans per year

Flexible patient scheduling

Can be performed in any IR suites

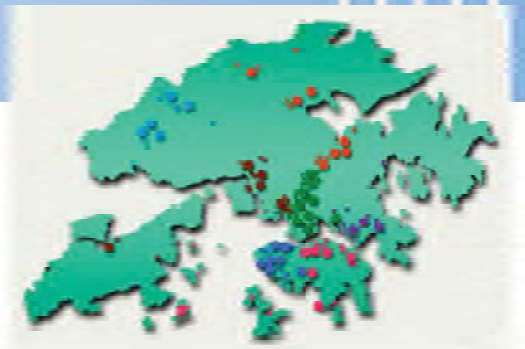
Reduced patient waiting times

For solid and subsolid lesions >=1.5cm

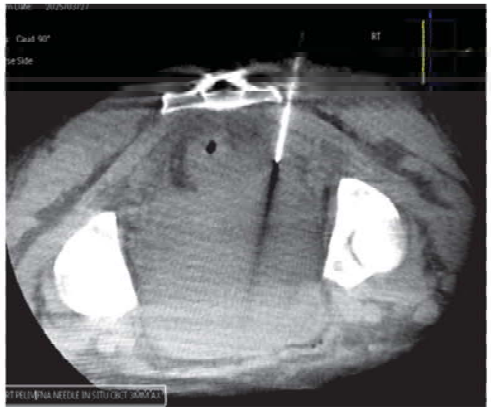
	Before CBCT/Fluoroscopy biopsy service	After CBCT/Fluoroscopy biopsy service
Median time from request to procedure appointment (days)	44	31.5

wait time by 2 weeks

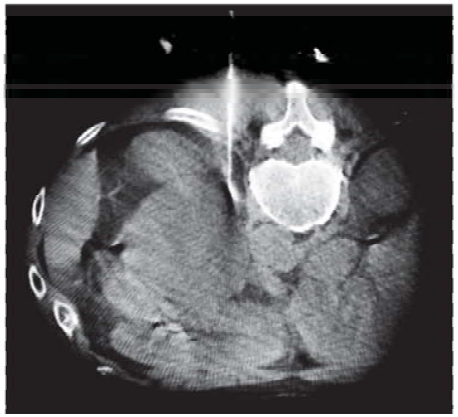
Future directions



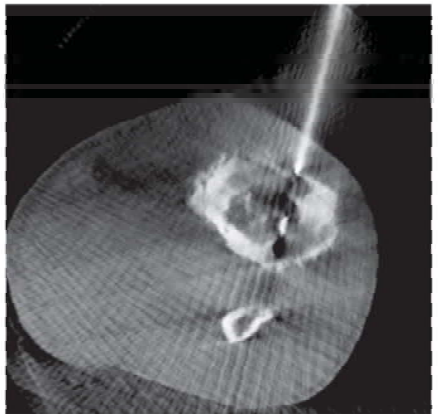
- **Adoption in other hospitals**
- Biopsies of **other organs**
- In combination with **other IR procedures** to improve accuracy



Drrainage of tubo-ovarian abscess



Biopsy of adrenal mass



Biopsy of bone lesion in lower extremity

Conclusion

- **Significant increase in imaged guided biopsy capacity**
- **Faster biopsies, Faster diagnosis and treatment, Better patient outcomes**
- **Comparable diagnostic yield, complication rates, procedure time** compared to conventional CT-guided biopsy
- **Future applications** in other hospitals and other IR procedures

Acknowledgements

- IR team (radiologists, radiographers and nurses)

Disclosure

- Patient consent obtained for all photos and videos used in this presentation.

Thank You