Prevalence of pneumothorax identified by PET/CT following transthoracic needle lung biopsy

Timothy Miao1, Joseph Sommerfeldt2, Eugene Leung2, Ashish Gupta3, Joao R. Inacio3, Lionel S. Zuckier2

1Faculty of Medicine, University of Ottawa
2Division of Nuclear Medicine, Department of Medicine, University of Ottawa
3Department of Medical Imaging, The Ottawa Hospital

Background

- Two relatively recent technologies which have impacted work-up and staging of lung cancer are transthoracic needle biopsy (TTNB)1 and FDG-PET/CT scanning3.
- Following TTNB, all patients at The Ottawa Hospital are screened by a posteroanterior (PA) chest x-ray 30 minutes after biopsy.
- While the incidence of pneumothorax immediately after biopsy is not infrequent (approximately 23%), patients are triaged based on physical findings and the stability of the pneumothorax.
- If an asymptomatic pneumothorax is identified, a second radiograph is obtained approximately 1 hour thereafter.
- If the patient remains asymptomatic and the pneumothorax has not enlarged, the patient is discharged home with instructions to return to hospital for treatment if they become increasingly breathless or experience worsening chest pain.
- The majority of asymptomatic patients with pneumothorax return home with conservative management6.
- The prevalence of delayed pneumothoraces after lung biopsy is less well studied.
- FDG-PET scanning has become a mainstay of characterizing lung nodules, as well as an important method of tumour staging5. Current scanners incorporate an in-line PET and CT scanner, the latter used both for attenuation correction estimations and for anatomic localization.
- In the effort to provide timely work-up, FDG-PET/CT scans are scheduled in close proximity to TTNB. Indeed, a demonstrable incidence of pneumothorax in these relatively asymptomatic outpatients has been observed in these PET/CT studies.

Methods

- Patients with a solitary lung nodule who underwent FDG-PET scanning within 1 week following TTNB from January 2013 to December 2013 were identified from the PACS database.
- Excluded were patients with biopsy performed at an outside institution and endotracheal biopsy.
- The biopsy reports were searched for biopsy method, side and lobe of lesion, and needle type.
- Presence of pneumothorax on chest x-ray immediately post-procedure and management used (i.e. chest tube insertion) were noted.
- The PET reports were reviewed for documentation of the presence and size of pneumothorax.
- Patients were categorized according to number of days the FDG-PET scan was performed after biopsy.
- From 1 to 7 days

Results

Patient demographics:
- 142 patients underwent PET scans within 7 days after biopsy
- 68 male (47.8%)
- Mean age: 68.9 ± 10.6 years
- 5 had prior thoracic surgery, 12 had prior lung biopsy
- 3 biopsies were failed and excluded → 139 eligible patients

Biopsy data:
- Immediate post-procedure chest x-ray:
  - 13 tiny, 28 small, and 4 moderately sized pneumothoraces detected
  - 1 hour delayed chest x-ray:
    - 10 enlarged, 9 decreased in size and 26 stayed constant

PET after biopsy:

- Interval between biopsy and PET (days) | # of patients | PET detected on PET/CT | Frequency (%) |
- 1 | 16 | 5 | 31 |
- 2 | 31 | 7 | 23 |
- 3 | 17 | 3 | 18 |
- 4 | 16 | 1 | 0.06 |
- 5 | 15 | 3 | 20 |
- 6 | 20 | 3 | 15 |
- 7 | 23 | 1 | 0.043 |

Total 139 23

Natural history:

- Interval post-biopsy chest x-ray | # of studies with no PTX visible | PTX

- 15 tiny PTX
- 28 small PTX
- 4 moderate PTX

Conclusion

- In the subset of patients that underwent PET scanning within a week following lung biopsy, there is an appreciable frequency of pneumothorax.
- The frequency of pneumothorax is inversely correlated with the number of days between PET and biopsy (r = 0.777, p = 0.040).
- Because of the high frequency of pneumothorax encountered during staging PET/CT, nuclear medicine technologists and physicians must become expert in recognition of this finding.

Limitations:
- Due to the retrospective nature of this study, larger pneumothoraces immediately post-biopsy may have been diverted to management and thus missed in both the PET reports and the calculation of frequency.
- Another limitation is the small sample size and narrow date range (some pneumothoraces may have persisted or grown past 7 days).

References


Future Directions

- In the future, the dataset will be expanded:
  - Another year of eligible PET studies (i.e. from January 2014 to December 2014) will be identified to increase sample size.
  - PET scans performed up to 2 weeks following lung biopsy will be analyzed.
- Management of delayed pneumothorax will be studied:
  - Rates of chest tube insertion, non-emergent follow-up, presentation to emergency department with symptoms, and admission to hospital will be evaluated.
- Two board certified radiologists will re-review the PET/CT scans for presence of pneumothorax.
  - True numerical size of pneumothorax will be measured.
  - These results will be compared with the PET reports to estimate the accuracy of the nuclear medicine readers in detecting incidental pneumothorax on PET/CT scans.

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Contact:
Timothy Miao
MD Candidate, Class of 2017
Faculty of Medicine, University of Ottawa
tmiao047@uottawa.ca