Mar 19, 2019

Working

Complications of CT-guided lung biopsy with a non-coaxial semi-automated 18 gauge biopsy system: frequency, severity and risk factors

PLOS One

Amany Elshafee[1], Annika Karch[2], Kristina I. Ringe[3], Hoen-oh Shin[3], Hans-Jürgen Raatschen[3], Nermin Yehia Soliman[4], Frank Wacker[3], Jens Vogel-Claussen[3]

[1]Institute of Diagnostic and Interventional Radiology, Hannover Medical School, Hannover, Germany, German Centre for Lung Research, Hannover, Germany, Institute of Diagnostic and Interventional Radiology, Faculty of Medicine Mansoura University, Mansoura, Egypt., [2]Institute for Biostatistics, Hannover Medical School, Hannover, Germany. , [3]Institute of Diagnostic and Interventional Radiology, Hannover Medical School, Hannover, Germany, German Centre for Lung Research, Hannover, Germany., [4]Institute of Diagnostic and Interventional Radiology, Faculty of Medicine Mansoura University, Mansoura, Egypt.

dx.doi.org/10.17504/protocols.io.wvrfe56

Amany Elshafee
Institute of Diagnostic and Interventional Radiology, Hannov...

ABSTRACT

Abstract:

Objectives: To evaluate frequency and severity of complications after CT-guided lung biopsy using the Society of Interventional Radiology (SIR) classification, and to assess risk factors for overall and major complications.

Methods: 311 consecutive biopsies with a non-coaxial semi-automated 18 gauge biopsy system were retrospectively evaluated. Complications after biopsy were classified into minor SIR1-2 and major SIR3-6. Studied risk factors for complications were patient-related (age, sex and underlying emphysema), lesion-related (size, location, morphologic characteristics, depth from the pleura and histopathology), and technique-related (patient position during procedure, thoracic wall thickness at needle path, procedure time length and number of procedural CT images, number of pleural passes, fissure penetration and needle-to-blood vessel angle). Data were analyzed using logistic and ordinal regression.

Results: Complications were pneumothorax and pulmonary hemorrhage. The complications were minor SIR1-2 in 142 patients (45.6%), and major SIR3-4 in 25 patients (8%). SIR5-6 complications were not present. Emphysema, smaller deeply located lesion, increased puncture time length and number of procedural CT images, multiple pleural passes and fissure puncture were significant risk factors for complications severity in univariate analysis. Emphysema (OR=8.8, p<0.001), lesion depth from the pleura (OR=1.9 per cm, p<0.001), and fissure puncture (OR=9.4, p=0.01) were the independent factors for major complications in a multiple logistic regression model. No statistical difference of complications rate between the radiologists performing biopsies was observed.

Conclusions: Knowledge about risk factors influencing complications severity is important for planning and performing CT-guided lung biopsies.

EXTERNAL LINK

https://doi.org/10.1371/journal.pone.0213990

THIS PROTOCOL ACCOMPANIES THE FOLLOWING PUBLICATION

Elshafee AS, Karch A, Ringe KI, Shin H, Raatschen H, Soliman NY, Wacker F, Vogel-Claussen J (2019) Complications of CT-guided lung biopsy with a non-coaxial semi-automated 18 gauge biopsy system: Frequency, severity and risk factors. PLoS ONE 14(3): e0213990. doi: 10.1371/journal.pone.0213990

PROTOCOL STATUS

Working

GUIDELINES

This retrospective study was a single Tertiary Centre cohort study. It was approved by the institutional review board.

MATERIALS TEXT

The study group consisted of 311 CT-guided core lung biopsies (127 women and 184 men; mean age, 62.2 years). 85 biopsies (27.3%) were performed in hospitalized patients.

SAFETY WARNINGS

- Procedural CT acquisitions were obtained to check that the needle tip reached the target lesion properly.
- After needle removal, post-biopsy CT images were acquired to detect complications.
- The patients were instructed to rest without eating for 2 hours after biopsy to reduce the incidence of post-biopsy pneumothorax.
- In our institution, a follow-up chest PA radiograph was routinely obtained 2 hours after biopsy to assess post-biopsy complications in particular pneumothorax, and if needed, further follow-up radiographs were performed.

BEFORE STARTING

- Patient written informed consent of CT-guided biopsy was obtained before the intervention.
- Pre-procedure complete blood count and coagulation profile were obtained. The biopsy was performed with platelet count at least 50.000/mm^3, prothrombin time >60%, and partial thromboplastin time $\leq$1.5 times.
- Before beginning the procedure, the interventional strategy, especially patient's position and biopsy pathway were planned using pre-biopsy chest CT images.

1 All consecutive CT-guided core lung biopsies recorded in our database from May 2011 to July 2014 were retrospectively analyzed. A total of 335 biopsies were assessed. Inclusion criteria included patients who underwent CT-guided lung biopsy with available images and reports.5 canceled biopsies were excluded from the analysis due to lack of immediate post-procedural CT scans and follow-up chest radiographs. Fifteen patients underwent two repeated biopsies and two patients underwent three biopsies, for the same lesion in a different session within one month from the initial biopsy. For each patient with repeated biopsy, only one biopsy was included to the dataset in order to avoid dependent data in the statistical analysis, thus only the last procedure was used. The final study group consisted of 311 CT-guided core lung biopsies (127 women and 184 men; mean age, 62.2 years). 85 biopsies (27.3%) were performed in hospitalized patients.

2 Procedural and post-procedural CT images, as well as patient- and procedure-related information recorded in both our electronic medical record system and radiological reports of biopsy procedures, were retrospectively reviewed for all biopsies.

3 Complications of the procedure, commonly pneumothorax and pulmonary hemorrhage, were assessed using CT scan obtained directly after the intervention as well as follow up chest PA radiographs after the intervention. Other complications were also assessed.
Management of post-biopsy complications for each patient was reviewed and period of hospital stay, if the patient required, was calculated. If the patient, who had the biopsy, was already hospitalized because of other causes rather than post-biopsy complications, only management of post-biopsy complications was being taken in consideration on the basis of the retrospective review.

4 Complications were classified according to the Society of Interventional Radiology (SIR) Guidelines into: No complication SIR0, minor complications SIR1-2, and major complications SIR3-6.

Minor complications SIR1-2: Intervention-related complications not requiring treatment SIR1, or requiring overnight admission for observation only SIR2.

Major complications SIR3-6: Intervention-related complications requiring treatment or hospital admission (minor hospitalization<48h SIR3 and prolonged hospitalization>48h SIR4), or permanent adverse sequelae SIR5, or death SIR6.

5 Multiple variables were evaluated as potential risk factors for complications.
Studied risk factors for complications were patient-related (age, sex and underlying emphysema), lesion-related (size, location, morphologic characteristics, depth from the pleura and histopathology), and technique-related (patient position during procedure, thoracic wall thickness at needle path, procedure time length and number of procedural CT images, number of pleural passes, fissure penetration and needle-to-blood vessel angle)

6 Statistical analysis

- Statistical analysis was performed using JMP (SAS statistical software, version 14.0, SAS Institute, Inc; Cary; NC, USA) and SPSS (IBM SPSS version 24.0, SPSS Inc. Chicago, USA). Descriptive results of continuous parameters were given as mean (95% confidence interval CI); ordinal and nominal parameters were presented as absolute frequency (%). As a first descriptive analysis, the association between complications measured by SIR classification and continuous parameters was analyzed using analysis of variance (ANOVA), whereas association of SIR complications with ordinal and nominal parameters was assessed using chi-square tests.
- A univariate logistic regression analysis was performed in relation to SIR score (no and minor complications SIR0-2 vs. major complications SIR3-6). In case of complete separation of the outcome in any category of a predictor, logistic regression with firth correction was done. A multiple logistic regression model was built from a medical point of view taking into account the significant predictors from univariate analysis causing no statistical difficulties due to multicollinearity.
- Furthermore, a univariate ordinal regression was performed for SIR0-6 as ordinal response variable to support the results from univariate logistic regression.
- Odds ratios (OR) with 95% confidence intervals (CI) were presented for logistic (and ordinal) regressions. In the statistical tests, a p value <0.05 was considered significant.