Percutaneous CT-guided biopsy of hilar lesions: Diagnostic accuracy and complication rate

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Purpose

Percutaneous needle biopsy for the diagnosis of pneumonia and bronchial carcinoma was first described at the end of last millennium, long before radiographic techniques were available (1, 2).

The procedure was revolutionized by modern projection fluoroscopy, the use of 18- to 20-gauge biopsy needles, and at last by the advent of Computed tomography (CT) scanning.

Formerly most lung biopsies were performed using fine-needle aspiration for cytologic evaluation but cutting needles for histologic evaluation are more commonly used today (3).

Lesions located within the lung hilum represent a challenging task to biopsy due to the close spatial relationship to important anatomic structure including large bronchi as well as large pulmonary and bronchial arteries and veins (4). Additionally, a long biopsy path through aerated lung parenchyma in order to reach the lesion increases the risk for development of pneumothorax.

Earlier reports described percutaneous needle aspiration biopsy of hilar lesions but reported results represent pooled data of hilar and mediastinal resp. hilar, pulmonary and mediastinal lesions (5-9). In addition neither the location within the lung hilum nor particular procedure-related details of hilar lesions were reported (5-9).

To date to our best knowledge no report exists describing the application of cutting needle biopsy technique for hilar lesions.

For these reasons we evaluated the diagnostic outcomes of percutaneous CT-guided cutting needle biopsy of hilar lesions in our patient population in order to assess the safety and efficacy for this procedure.

Methods and Materials

In this retrospective study the relevant data sets of all consecutive patients which underwent percutaneous CT-guided cutting needle biopsy of hilar lesions during a 9 year interval (2000 - 2010) were electronically retrieved from the local PACS and hospital information system and further evaluated.

Only lesions located within the pulmonary hilum were included. For this, it was arbitrarily defined that 4/5 of the volume of the lesion must be located within a virtual hemisphere defined by a circular line connecting the bifurcation of the lobar bronchi of each side. In questionable large hilar lesions the contrast-enhanced CT data set were electronically
edited on a commercial available workstation located next to the CT scanner; the
boundary of the volume-rendered 3D model of the hilar lesion was marked and their
location within the virtual hemisphere evaluated.

All procedures were performed using a 16 - multislice CT scanner (LS16, General Electric
Healthcare, Milwaukee, Wiskonsin, USA) and a specialized axial CT scanning mode
for CT-guided biopsy (SmartStep®, General Electric Healthcare, Milwaukee, Wiskonsin,
USA) including an in-room monitor, foot paddle and control board mounted to the CT
table.

In total 72 CT-guided percutaneous cutting needle biopsy procedures were performed in
71 patients (31 woman, 40 men) aged 1 - 79 years (mean age: 58,9 ± 13,7 years).

Maximal hilar lesions size in the transverse plane measured 1,5 - 4,9 cm (mean 1,2 ± 1,3
cm); the hilar lesion were located 39x on the right side and 32x on the left side.

Two senior radiologist with 10 resp. 5 year experience in CT-guided biopsy of the
lung performed the majority of procedures (51x resp. 16x); additional procedures were
performed by three different radiology fellows (2x resp. 1x resp. 1x).

The majority of procedures were performed in general anesthesia (68x); only 2 procedures
were performed in local anesthesia.

A single angulated approach (54x) without gantry tilt was used more often than a double-
angulated approach (18x) with additional cranial or caudal gantry tilt (range: +15° to
-18,5°).

A coaxial needle system comprising a detachable 17-gauge introducer needle and a 18-
gauge cutting biopsy needle within an automated biopsy gun (C.R. Bard, Inc., Murray Hill,
New Jersey, USA) was used with a mean number of 6,8 ± 2,5 biopsy attempts (range:
0 - 15); mean length of path through aerated lung parenchyma measured 5,2 ± 2,0 cm
(maximum up to 8.0); procedure time was 12 - 70 minutes (mean 12 ± 70) and exposure
time was 12 - 88 seconds (mean 31,5 ± 14,6).

In 71 procedures the needle tract was obliterated with fibrin glue (Tissucol® or Tisseel®,
Baxter International Inc., Deerfield, Illinois, USA); in one procedure the needle tract was
obliterated with a blood-patch technique.

Images for this section:
**Fig. 1:** 54 year-old female after right upper lobe resection due to bronchial carcinoma 2 years ago. CT-guided cutting needle biopsy was performed due to newly developed suspicious right hilar lymphadenopathy. Microscopic evaluation revealed anthracosis and sinushistiocytosis without recurrent carinoma; follow-up CT scanning demonstrated almost complete resolution of right hilar lymphadenopathy. Figure 1, A + B: Contrast-enhanced MDCT of chest with right hilar lymphadenopathy.
Fig. 2: Figure 1, C - H: Subsequent steps of CT-guided cutting needle biopsy. Figure 1, E - F: Contrast-enhanced series with the coaxial needle in place (next to right hilar lymphadenopathy) just before biopsy in order show neighboring vascular structures. Figure 1, H: CT scan at the end of procedure after removal of coaxial needle und after needle tract obliteration with fibrin.
Fig. 3: 56 year-old man with newly diagnosed left hilar lymphadenopathy without evidence of an intrapulmonary nodule and unremarkable bronchoscopy. CT-guided cutting needle biopsy of left hilar lymphadenopathy and subsequent microscopic evaluation revealed small-cell carcinoma of the bronchus (SCLC). Figure 1, A + B: Contrast-enhanced MDCT of chest with left hilar lymphadenopathy. Figure 1, C - H: Subsequent steps of CT-guided cutting needle biopsy.
Fig. 4: Figure 1, C - H: Subsequent steps of CT-guided cutting needle biopsy. Figure 1, E - F: Contrast-enhanced series with the coaxial needle in place (next to left hilar lymphadenopathy) just before biopsy in order show neighboring vascular structures. Figure 1, H: CT scan at the end of procedure after removal of coaxial needle and after needle tract obliteration with fibrin.
Results

The biopsy diagnoses were classified into the following three categories: malignant, benign, and nondiagnostic. The results were considered nondiagnostic if the obtained were inadequate for definite histological diagnosis. Diagnoses of malignant and benign disease were considered as positive and negative results, respectively.

The final diagnosis was determined to be malignant disease when malignancy was confirmed in the surgical specimen, the istology of the lesion was comparable with a known malignancy in the patient, ore the postprocedural course was consistent with obvious malignant processess (eg. Increased in lesion size, lesion regression by chemotherapy, ore appearance of metastasis).

The final diagnosis was determined to be benign disease when it was confirmed in the surgical specimen, the lesion regressed with conservative or medical therapy, or the lesion was stable in size for at least 2 years.

Positive biopsy results were further classified as true-positive or false-positive if the final diagnosis was malignant or benign disease, respectively.

Negative biopsy results were further classified as true-positive or false-positive if the final diagnosis was benign or malignant disease, respectively.

The sensitivity, specificity, positive predictive value (PPV), and negative predictive value (NPV) for the diagnosis of malignancy and the diagnostic accuracy were calculated.

Nondiagostic results were obtained in 2 of the 72 lesions (2,8%) owing to the acquisition of insufficient material for diagnosis and not to the termination of the procedure before specimen acquisition.

Core biopsy samples from the remaining 72 lesions (92,2%) were adequate for diagnosis.

Histologic evaluation of the biopsy specimens revealed malignancy in 56 (77,6%) and benign findings in 16 (22,4%) of 72 lesions.

The biopsy diagnosis of malignant disease was made for 19 lesions (26,4%) and benign disease in 56 lesions (73,1%).

The overall sensitivity, specificity, PPV, and NPV for the diagnosis of malignancy were 94,6%, 100%, 100%, 86,4% respectively.

Perilesional hemorrhage was observed in 29 (40,2%) procedures but did not obscure any lesions during biopsy; in 1 (1,3%) procedures self-limited hemoptysis was noted. Pneumothorax developed in 8 (11,1%) of 32 procedures and only one (1,3%) required CT-guided percutaneous chest tube placement; no further morbidity or mortality occurred.
Conclusion

CT-guided percutaneous core biopsy of hilar lesions is a safe and effective technique to obtain adequate samples for histologic examination.

References


Personal Information