

Rapid needle-out patient-rollover approach after CT-guided lung biopsy: challenges and future directions

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Indeterminate pulmonary nodules are a frequent clinical problem that will undoubtedly increase with the advent of lung cancer screening and the use of low dose chest computed tomography (CT) (1). Several guidelines suggest that a percutaneous CT biopsy is feasible for pulmonary nodules >8 mm in size or 300 mm³ in volume (2,3).

The decision to perform a percutaneous biopsy is dependent on whether a result will affect clinical management and the potential benefits outweighing the risk. The principal risks of percutaneous pulmonary nodule biopsy are pneumothorax, pneumothorax requiring chest drain insertion and hemorrhage.

The reported rates of pneumothorax vary widely in the literature (from 6.5% to 69%) and the frequency of chest drain insertion also shows a wide reported variability (2.5% to 32.3%) (1,4-7). A large biopsy series published in 2006 showed an incidence of 15% for pneumothorax and 6.6% for chest drain insertion (8). Multiple interventional techniques have been investigated in an attempt to reduce the incidence of pneumothorax and chest drain insertion including injection of material along the biopsy tract, pleural blood patching and aspiration of a pneumothorax present at the end of a biopsy (9-12). Others have assessed patient position post biopsy with numerous studies evaluating placing the patient biopsy side down (13-15). Two studies, including this study by Kim *et al.* have evaluated placing the patient biopsy side down using a rapid needle-out patient-rollover technique in an attempt to decrease the incidence of pneumothorax (16,17).

This study by Kim *et al* describes the largest series of both the use of CBCT and also the rapid needle-out-patient rollover technique with 1,227 percutaneous needle

biopsies in 1,191 patients ranging in age from 9 to 91 years of age (17). The authors divided the patient population into two groups with 617 biopsies performed in a conventional manner and 610 biopsies performed with a rapid needle-out patient-rollover approach. There was a statistically significant decrease in the incidence of pneumothorax requiring chest drain (chest drain insertion was performed for symptomatic patients or patients with pneumothorax >35%). However there was no decrease in the overall incidence of pneumothorax. Univariate and multivariate analysis demonstrated that emphysema along the needle tract and crossing of a bulla were associated with increased risk of pneumothorax requiring chest drain.

The lack of a statistically significant decrease in the rate of pneumothorax compared to other rapid rollover studies is likely multifactorial. There were a higher number of pleural punctures in the rapid rollover group (more than 3 samples taken in 94 biopsies compared to in 46 biopsies in the conventional group in this study), multiple operators with varying levels of experience compared to a single experienced operator were involved, the pneumothorax evaluation at the end of procedure was performed with CBCT compared with CXR and the time to patient rollover was longer, which the authors suggest may be due to the narrow CBCT table (24.6±9.2 seconds compared to 9.5±4.8 seconds) (16,17). On multivariate analysis in both groups the rate of pneumothorax was higher in male patients, >60 years of age, emphysema along the needle tract, crossing a bulla or fissure, longer pleura to target distance and ≥2 pleura punctures. Interestingly, the number of delayed pneumothoraces seen on the chest radiograph performed three hours post procedure was lower in the rapid-rollover group suggesting an

additional benefit from the rapid patient rollover technique (35 patients in the rapid patient rollover group compared to 57 patients in the conventional group).

In an authoritative commentary on percutaneous lung biopsy, Moore *et al.* emphasized the use of the patient rollover technique in reducing the prevalence of pneumothorax requiring chest drain insertion (13). Although several subsequent studies attempted to emulate her findings, the issue of the rapidity with which the technique should be performed did not form a central focus of the validating studies. Thus, the technique has not found widespread application in many academic centers, despite the presence of thoracic radiological interventional expertise. This paper by Kim *et al.* corroborates our experiences in using the rapid needle-out patient rollover technique and is an important validation of the technique in a large randomized cohort of patients. Several practical aspects of the technique deserve emphasis. In our center, we utilize technologists, healthcare assistants and nurses to assist in rapidly rolling the patient over to biopsy side down, using a slide sheet if necessary in poorly mobile patients. We generally place the patient's bed immediately adjacent to the CT table, and roll the patient directly onto their bed into the biopsy side down position. We aim for a rapid needle-out patient rollover time of less than ten seconds. Although we prefer to monitor the patients with chest radiographs post procedure, many centers perform a CT immediately after the biopsy to assess for pneumothorax, and in these instances the patient can be rolled over on the CT table itself. The key is that the rollover must be rapid. If the rollover takes more than approximately 10-15 seconds, air may have had time to accumulate in the pleural space and the pneumothorax process may progress. What are the challenges to implementing the technique going forward? A key point is to raise awareness of the evidence for the technique. It is encouraging to note that contemporary guidelines have begun noting the use of the rapid needle-out patient rollover technique by specifically citing studies evaluating it. The British Thoracic Society Pulmonary Nodule guidelines refer for the first time to the 'rapid needle-out patient rollover time' technique in their discussion (18). They do not make a specific recommendation on its use based on the single study available at the time of writing. Further validating randomized studies, in multiple centers by multiple practitioners will be needed before the technique is accepted into general thoracic interventional clinical practice. The published evidence supporting the use of the technique continues to grow while the chest drain insertion rate

continues to decline in centers performing the technique.

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Footnote

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