Rapid On-Site Pathologic Evaluation Does Not Increase the Efficacy of Endobronchial Ultrasonographic Biopsy for Mediastinal Staging

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Background. Endobronchial ultrasonography with transbronchial needle aspiration (EBUS-TBNA) has been shown to be equivalent to mediastinoscopy in lung cancer staging for mediastinal node involvement. Rapid on-site evaluation (ROSE) to determine the adequacy of nodal sampling has been claimed to be beneficial.

Methods. A retrospective evaluation was performed in 170 patients who underwent EBUS-TBNA from July 2008 to May 2011. The patients were classified as having either high or low pretest probability for mediastinal disease based on history and radiographic imaging. ROSE was compared with the final pathology reports based on slides and cell blocks.

Results. One hundred thirty-one (77%) patients were classified as being in the high pretest cohort based on clinical staging. Of these, 101 (77%) patients had adequate tissue sampling based on ROSE, with 70 (69%) patients having positive mediastinal disease. In the 30 (23%) patients who had inadequate tissue by ROSE, the final analysis of all the prepared slides and cell blocks allowed for a diagnosis in all but 8 patients. The sensitivity and specificity of ROSE in the high pretest probability cohort were 89.5% and 96.4%, respectively, whereas the overall sensitivity and specificity of EBUS-TBNA was 92.1% and 100%, respectively. Despite having inadequate tissue on ROSE in 30 of 131 patients, sufficient tissue was available on final analysis for diagnosis in 22 of 30 patients.

Conclusions. ROSE does not impact clinical decision making if a thorough mediastinal staging using EBUS is performed. Despite inadequate tissue sampling assessment by ROSE, a final diagnosis was made in most patients, potentially avoiding an additional surgical procedure to prove mediastinal disease.


EBUS-TBNA with ROSE followed by a cervical mediastinoscopy in the same setting for patients felt to be at high risk for mediastinal node involvement with cancer. If ROSE was negative or inadequate tissue was described on ROSE, a cervical mediastinoscopy was performed with intention of surgical resection at the same setting, based on a negative frozen section on mediastinoscopy. The potential scenario of patients undergoing unnecessary procedures because of the diagnostic challenges on ROSE, however, made us evaluate our experience.

Material and Methods
A total of 170 patients undergoing EBUS for mediastinal staging for lung cancer from July 2008 to May 2011 were reviewed retrospectively. All procedures were done by surgeons who had incorporated EBUS into their practice in the preceding 2 years using general anesthesia in the operating room. This study was approved by the University of North Carolina Institutional Review Board.

Demographic and pertinent clinical risk factors were reviewed. The patients were classified as having either a high or low pretest probability for cancer based on the following criteria: (1) patients had positive radiologic
findings suggesting malignancy (ie, lung mass) or
unknown primary with mediastinal disease (> 1 cm
mediastinal adenopathy or fluorine-18 fluorodeoxy-
glucose avidity on positron emission tomography);
(2) clinical staging suggested a high likelihood of medi-
astinal disease (ie, stage T3 or higher); and (3) patients
were evaluated by a cardiothoracic surgeon and there
was clinical evidence of mediastinal node disease.
The presence of 2 of 3 criteria categorized patients as having
a high pretest probability of malignancy with mediastinal
disease. All patients were presumed to have lung cancer
based on risk factors and radiologic imaging.

The number and location of nodal stations aspirated for
the EBUS-TBNA were recorded. The conclusion of ROSE
was recorded along with the results from the final
pathology reports. EBUS-TBNA was performed using an
EBUS bronroscope (Model BF-UC180F; Olympus,
Tokyo, Japan) with a single-use 22-gauge TBNA needle
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Tokyo, Japan) with a single-use 22-gauge TBNA needle
(Mariakerke, Belgium).

Results
A total of 170 patient charts were reviewed. Patient
demographics—including mean age, smoking history,
and mean pulmonary function values—were recorded.
Mean patient demographics were similar for both cohorts,
with the exception of male predominance and increased
smoking history in the high pretest group (Table 1). A
total of 131 (77%) patients were classified as being in the
high pretest group based on clinical staging (Fig 1). The
majority of these patients (92%) had clinical stage IIIA or
higher; the remaining patients were unable to be
appropriately staged by clinical criteria because there
was additional history of other oncologic malignancy or
central lesions. All patients were presumed to have lung
cancer based on risk factors and radiologic imaging in
this group, with the exception of 8 patients who had risk
factors for both lung cancer and a history of previous
oncologic malignancies. Of these, 101 patients had
adequate tissue sampling based on ROSE, of whom 70
(69%) patients had positive mediastinal disease by
ROSE. Analysis of all the prepared slides and cell blocks
confirmed mediastinal disease in 68 patients, with 2
patients having a false-positive ROSE result. Final

Table 1. Patient Demographics of Both High Pretest
Probability and Low Pretest Probability Cohorts (N = 170)

<table>
<thead>
<tr>
<th>Variable</th>
<th>High Pretest Cohort (n = 131)</th>
<th>Low Pretest Cohort (n = 39)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sex</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>79 (60%)</td>
<td>15 (38.5%)</td>
</tr>
<tr>
<td>Female</td>
<td>52 (40%)</td>
<td>24 (61.5%)</td>
</tr>
<tr>
<td>Age (y)</td>
<td>62.7 ± 11.2</td>
<td>58.6 ± 16.5</td>
</tr>
<tr>
<td>History of smoking</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>104 (79%)</td>
<td>21 (54%)</td>
</tr>
<tr>
<td>No</td>
<td>27 (21%)</td>
<td>18 (46%)</td>
</tr>
<tr>
<td>Mean number stations biopsied</td>
<td>1.5 ± 0.7 (range, 1–3)</td>
<td>1.5 ± 0.6 (range, 1–3)</td>
</tr>
</tbody>
</table>
pathologic analysis in these patients with a positive ROSE result was stratified according to histologic type, with predominance toward adenocarcinoma (Table 2). Of the remaining 31 patients in the high pretest group (31%) with adequate tissue, the final analysis of prepared slides and cell blocks confirmed the finding of no evidence of malignancy by ROSE. Only 1 patient had a false-negative EBUS result.

In the 30 (23%) patients who had inadequate tissue by ROSE, final analysis of prepared slides and cell blocks allowed for a diagnosis in all but 8 patients. Surgery revealed cancer in only 3 of these 8 patients, with the remaining 5 patients having a negative diagnosis of malignancy based on the surgical pathologic evaluation. Two of the 30 patients, however, were identified as having mediastinal disease on the surgical pathologic specimen, despite a negative final analysis of the prepared slides and cell blocks.

In the low pretest group, 34 of 39 patients had adequate tissue based on ROSE, with 33 patients having congruent negative results on ROSE and final cytologic analysis of all prepared slides and cell blocks.

Fig 1. Flow diagram of a total of 131 patients classified as being in the high pretest probability cohort based on clinical staging. (EBUS = endobronchial ultrasonography; ROSE = rapid on-site evaluation.)
Finally, the diagnostic yield of ROSE was determined in the high pretest probability cohort. Thirty of 131 patients were deemed to have inadequate tissue on ROSE for a diagnosis. Twenty-two of these patients, however, had adequate tissue for diagnostic determination on final cytologic analysis. Based on this, the diagnostic yield for EBUS increased from 77.1% (101 of 131) to 93.9% (123 of 131) (Fig 3).

**Comment**

EBUS-TBNA has emerged as a safe and effective tool in the diagnosis and staging of malignant tumors in the lung and for the evaluation of mediastinal lymphadenopathy [1–3]. The advantages of ROSE of cytologic specimens, however, is debatable. Several authors have shown that the presence of ROSE with fine-needle aspiration increases the diagnostic yield, particularly in nonoperative settings and with the use of esophageal endoscopic ultrasonography [10, 11]. This has not universally proved to be true in the setting of mediastinal staging for cancer with EBUS-TBNA and ROSE [12].

In a randomized trial evaluating the effect of ROSE on diagnostic yield, Trisolini and colleagues [8] showed that there was no difference in TBNA with or without ROSE. The number of biopsy sites per patient was lower in the ROSE group versus the TBNA group (1 versus 2 sites) and there was a lower complication rate with ROSE (6%...)

### Table 2. Final Pathologic Type on Analysis if Positive on ROSE (N = 68)

<table>
<thead>
<tr>
<th>Variables</th>
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</thead>
<tbody>
<tr>
<td>NSCLC</td>
<td></td>
</tr>
<tr>
<td>Adenocarcinoma</td>
<td>35 (51%)</td>
</tr>
<tr>
<td>Squamous cell</td>
<td>15 (22%)</td>
</tr>
<tr>
<td>SCLC</td>
<td>10 (15%)</td>
</tr>
<tr>
<td>Large cell</td>
<td>1 (1.5%)</td>
</tr>
<tr>
<td>Metastatic</td>
<td></td>
</tr>
<tr>
<td>Melanoma</td>
<td>2 (3%)</td>
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<tr>
<td>Ovarian</td>
<td>1 (1.5%)</td>
</tr>
<tr>
<td>Breast</td>
<td>3 (4%)</td>
</tr>
<tr>
<td>Endometrial</td>
<td>1 (1.5%)</td>
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NSCLC = non–small cell lung cancer; ROSE = rapid on-site evaluation; SCLC = small cell lung cancer.

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NSCLC = non–small cell lung cancer; ROSE = rapid on-site evaluation; SCLC = small cell lung cancer.

### Fig 2. Flow diagram of 34 of 39 patients who had adequate tissue based on rapid-on-site evaluation (ROSE) in the Low Pretest Probability Cohort.

Thirty-three patients had congruent negative results on ROSE and final cytopathologic analysis. (ROSE = rapid on-site pathologic evaluation.)
versus 20%). Hence, Trisolini and colleagues concluded that ROSE enabled the avoidance of additional biopsies and thus reduced the complication rate of bronchoscopy. However, in this study, the higher complication rate in the TBNA group was related more to the choice of sampling equipment, being higher in those who underwent biopsy with forceps. It was not influenced by the time of bronchoscopy or the number of biopsy sites.

At our institution, our current procedural protocol follows that of the University of Toronto in which all stations are potentially evaluated for biopsy with EBUS and at least 3 to 5 passes per station are performed with or without ROSE [3, 13]. In our opinion, this approach allows a thorough assessment of the mediastinum and has no effect on our complication rates. In addition, this avoids the selective biopsy of mediastinal nodes, as was our previous practice with ROSE. When this approach is used, there is little impact on the diagnostic yield of EBUS-TBNA.

In our series, the sensitivity and specificity of EBUS-TBNA based on the final analysis of prepared slides and cell blocks were higher than that of ROSE and similar to previous studies that have validated the use of EBUS-TBNA [3]. The diagnostic yield (determining tissue adequacy) with ROSE was only 77.1%, but with final cytologic analysis it increased to 93.9%. More than 70% (22 of 30 patients) of the time when ROSE is inadequate, there is usually sufficient tissue on final analysis (smears and cell blocks) to make a diagnosis.

In addition, there are some diagnostic challenges with ROSE. This issue has been raised particularly in the pathology literature [9]. In our study, ROSE correlated with the final cytologic analysis in 98% (99 of 101) of patients who had adequate tissue sampling. In 30 patients (23%), there was inadequate tissue on ROSE, which led to a surgical mediastinal procedure. Some of these cases resulted from sampling, ie, diagnostic tumor cells were not present on the Diff-Quik–stained direct smears used for ROSE but were present on the fixed slides and/or the cell block. Other nondiagnostic cases may be related to what Monaco and associates [9] and others describe as the diagnostic challenges of ROSE: low baseline cellularity of the aspirates, bronchial contamination, the difficulty identifying neoplasms with bland cytologic evaluation, the wide spectrum of diseases that can occur in the mediastinum with overlapping cytomorphologic features, the mismatch between the background material and the cell populations present, and the overall unfamiliarity of the pathologist with these types of specimens.

The goal of avoiding repeated procedures in patients with potentially resectable lung masses makes EBUS with ROSE very attractive to patients as well as surgeons. Some authors have shown that the use of ROSE to dictate the number of biopsies taken per site may increase the yield of sampling [6]. This particular study did not take into account the efficiency of the operating room overall cost to the hospital from use of operating room time and was conducted in a reimbursement environment different from that in the United States. In our experience, ROSE decreases the efficiency and cost-effectiveness of the operating room. It is widely acknowledged that current reimbursement schemes are insufficient to support ROSE from the standpoint of the cytopathologist [14–16]. If the goal is to avoid unnecessary operations by relying on ROSE, this is not justified by our data. In our practice, indeterminate or negative ROSE results were often followed by invasive cervical mediastinoscopy in patients with high probability of N2 disease.

### Table 3. Contingency Table of Patients in the High Pretest Probability Cohort (N = 131)

<table>
<thead>
<tr>
<th>Patients</th>
<th>Disease Present (n = 76)</th>
<th>Disease Absent* (n = 55)</th>
</tr>
</thead>
<tbody>
<tr>
<td>ROSE-positive</td>
<td>68</td>
<td>2</td>
</tr>
<tr>
<td>patients (n = 70)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ROSE-negative</td>
<td>8</td>
<td>53</td>
</tr>
<tr>
<td>patients (n = 61)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* Includes patients with tissue inadequate/indeterminate for diagnosis on final analysis; *b* Includes patients who had inadequate tissue on ROSE (Fig 1b); *c* Includes patients whose final analysis or surgical pathologic evaluation was positive, with surgical pathologic evaluation taking greater preference.

ROSE = rapid on-site evaluation.

### Table 4. Patients With Final Cytopathologic Analysis in the High Pretest Probability Cohort (N = 131)

<table>
<thead>
<tr>
<th>Result</th>
<th>Disease Present (n = 76)</th>
<th>Disease Absent* (n = 55)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Final cytologic analysis</td>
<td></td>
<td></td>
</tr>
<tr>
<td>positive (n = 70)</td>
<td>70</td>
<td>0</td>
</tr>
<tr>
<td>Final cytologic analysis</td>
<td></td>
<td></td>
</tr>
<tr>
<td>negative (n = 61)</td>
<td>6</td>
<td>55</td>
</tr>
</tbody>
</table>

* True absence of disease is defined as negative ROSE, negative final cytologic analysis, and confirmation on surgical pathologic examination. Otherwise, the final pathologic result was taken from the test that yielded the most tissue, with surgical pathologic examination being the gold standard; *b* Includes patients with inadequate/indeterminate tissue for diagnostic final analysis.

ROSE = rapid on-site evaluation.

### Table 5. Diagnostic Capability of ROSE Compared With Final Analysis in High Pretest Probability Cohort (N = 131)

<table>
<thead>
<tr>
<th>Diagnostic Capability</th>
<th>Values</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diagnostic capability of ROSEa</td>
<td>89.5% (95% CI, 80.3%–95.3%)</td>
</tr>
<tr>
<td>Sensitivity</td>
<td>96.4% (95% CI, 87.5%–99.5%)</td>
</tr>
<tr>
<td>Specificity</td>
<td>97.1% (95% CI, 90%–99.6%)</td>
</tr>
<tr>
<td>NPV</td>
<td>86.9% (95% CI, 75.8%–94.2%)</td>
</tr>
<tr>
<td>PPV</td>
<td>92.1% (95% CI, 83.6%–97%)</td>
</tr>
<tr>
<td>Diagnostic capability of EBUSb</td>
<td>100% (95% CI, 93.5%–100%)</td>
</tr>
<tr>
<td>Sensitivity</td>
<td>100% (95% CI, 94.8%–100%)</td>
</tr>
<tr>
<td>Specificity</td>
<td>90.2% (95% CI, 79.8%–96.3%)</td>
</tr>
</tbody>
</table>

* Ability to confirm presence of malignancy.

EBUS = endobronchial ultrasonography; NPV = negative predictive value; PPV = positive predictive value; ROSE = rapid on-site evaluation.
nodal disease. Given the lack of diagnostic accuracy of ROSE, we no longer recommend this practice on a routine basis. Instead, we wait for the final pathologic evaluation from both smears and the cell block to make additional treatment recommendations. Our study is limited by a small sample size, and the data are from a single institution. The practice pattern we describe is, however, carried out at multiple institutions. Our data may be helpful in guiding practice patterns and the decision to perform a surgical procedure on the same occasion as the EBUS procedure.

In conclusion, ROSE does not alter diagnostic yield or help in clinical decision making when standardized and thorough mediastinal staging is performed. Even in cases in which tissue sampling is considered inadequate for ROSE, our data show that a final diagnosis is still obtained with EBUS-TBNA in most patients with a high pretest probability. At our institution, the thoracic surgery division no longer uses ROSE routinely. This may potentially avoid an additional surgical procedure to prove mediastinal disease at the same setting and may be more cost-effective.

This work was made possible by the generous support of the James and Elizabeth Anderson family.

References
15. Dhillon I, Pitman MB, Demay RM, Archuleta P, Shidham VB. Compensation crisis related to the onsite adequacy evaluation during FNA procedures—urgent proactive input from cytopathology community is critical to establish appropriate reimbursement for CPT code 88172 (or its new counterpart if introduced in the future). Cytojournal 2010;7:23.

DISCUSSION

DR STEPHEN R. HAZELRIGG (Springfield, IL): If the onsite pathology tells you there is not adequate tissue, did that change your behavior in the operating room? Did you then go get more tissue with EBUS or not?

DR JOSEPH: Our clinical practice prior to this study was exactly how you mentioned; it was reliant on the cytopathologist telling us if we had enough tissue. The most clinically relevant lymph node station, which would give the highest stage, would be biopsied first. Depending on what the cytopathologist told us, we would either stop if we had adequate tissue or we would continue biopsying other stations or continue with more passes in the same lymph node. Eventually if we didn’t have adequate tissue, that led to a mediastinoscopy at the same setting.
Our current practice is the same as the protocol at the University of Toronto, which is that we at least attempt to do a complete mediastinal sampling with 3 to 5 passes per lymph node station, and we are not really dependent on the cytopathologist at all. We perform a thorough mediastinal staging and we’re done.

DR HAZELRIGG: So if I understand right, you are not saying don’t have a pathologist on site to look at it; you are just saying don’t do a mediastinoscopy until after the final path comes back?

DR JOSEPH: Our paper suggests that you don’t have to do either.

DR HAZELRIGG: Well, I guess what I’m trying to get at is, are you suggesting we don’t need to have an onsite pathologist? We do EBUS?

DR JOSEPH: Correct. From our study what we are saying is 1, having an onsite pathologist is not beneficial; they’re not going to give you any additional information if your protocol is to get a full mediastinal sampling. Secondly, you can avoid doing a mediastinoscopy in most cases in the same setting if you do a full mediastinal lymph node sampling. In the past when the pathologist told us there wasn’t enough tissue, this prompted us to get more.

DR HAZELRIGG: So I guess what I’m struggling with a little bit here, and I apologize, is, if your pathologist is on site when you do it and he’s telling you you didn’t get adequate tissue, you’re doing something different, you’re doing some more biopsies of it, and if they’re not there, you’re not going to know that. So do you have any idea how often that actually happened, having the pathologist there even though I know the final pathology might have ended up they had enough tissue when they said they didn’t? How many times it changed your behavior in the operating room is what I’m trying to understand. Because it very well could be that it is still valuable to have them there because they said there wasn’t enough tissue and you went and got some more.

DR VEERAMACHANENI: Dr Hazelrigg, I can answer that question. This study started because we kept having this issue of our on-site pathologists not providing definitive diagnosis. Our practice was for all of these patients to undergo EBUS in the operating room, and they would be scheduled for a possible cervical mediastinoscopy. So, if we didn’t get the diagnosis by EBUS and on-site pathology, we didn’t put the patient through another anesthetic, so we’d proceed with a cervical mediastinoscopy.

What we found was that the on-site pathology was unreliable. So, in my first year and a half of practice, there were a lot of patients getting mediastinoscopy; I couldn’t give you the exact number right now. I’m sure we would have that data in the manuscript.

What we have been able to demonstrate is you don’t need to call the pathologist into the room. If you are reasonably comfortable with your technique, you make the necessary slides as well as an appropriate cell block and it looks like you have a reasonable coagulum by just visual inspection, you could stop and then go on with your day, so this has changed our practice.

DR HAZELRIGG: So now you have changed and you don’t have a pathologist on site?

DR VEERAMACHANENI: I don’t invite them into the room.

DR HAZELRIGG: It would be kind of interesting, and maybe I’m barking up the wrong tree here, to randomize, because we have it happen where they say there’s not enough tissue and then that does change our behavior in the operating room. I’m not saying we do a cervical “mead,” but we go get more biopsies of that lymph node.

I understand what you said. I just wonder if it changed behavior in the operating room where you end up getting more tissue that ended up resulting in getting a diagnosis even if it wasn’t made at that very moment in the operating room? So it would be interesting, I would suggest that it might be interesting to have them there in a prospective way, randomized whether it matters if they’re there or not.

DR VEERAMACHANENI: We are a lot more regimented in how we perform the procedure. So everybody is getting 3 to 5 passes at every nodal station that you see. We make sure that we have at least (grossly) what looks like adequate tissue. It has actually shortened our operative time, because from needle pass to slide to the needle coming back to my hands, (I’ve timed our bronch techs) it takes 2 minutes. So if you add a pathologist to look at the slide, each slide is an additional 12 minutes. This is a good way of speeding up the case.

DR JOSHUA ROBERT SONETT (New York, NY): Thanks, appreciate it. Excellently presented. Two questions. First, if you have decided that you are not going to do a “mead” at the time of your EBUS, why are you still doing it in the operating room under general anesthesia with the extra cost and burden of taking up OR time and a lot more extra cost? One of the huge advantages of EBUS is, frankly, I think, improving cost and less infliction on the patients. But in terms of our keeping them away from the OR, it is going to be a huge cost savings, and it doesn’t to make any sense to put them to sleep if we don’t have to.

That’s one.

And two, other papers have shown that you can do this without ROSE, but as we presented earlier, the ROSE can help guide you to get extra samples for molecular testing, which is really key to our diagnosis now. Did you look at your samples and your molecular analysis of those samples in terms of your yield?

Thank you.

DR JOSEPH: Thank you, Dr Sonnet, for those questions, 2 very great questions. To answer that first question, at our institution it is more of a logistics issue. We have one bronchoscopy suite that we actually share with the pulmonologists, and we see a lot more volume than they do. In terms of trying to fit the number of patients and try to share with them, it’s very hard to do, and that’s one of the reasons why we actually do ours in the operating room.

We have a quicker turnover but your point is well taken; they do have general anesthesia with an endotracheal tube. We have on occasion used an LMA and sedation. As mentioned before, the other reason was because these patients were consented for a mediastinoscopy at the same time as well. However, our practice has just recently changed, and therefore now not having to do a mediastinoscopy we’re hoping to change or practice soon, we do find it much more facile and easier to do.

DR SONETT: Easier on you but not the patient particularly.

DR JOSEPH: Agreed.

DR SONETT: General anesthesia is still general anesthesia with some increased risk and sides effects.
DR JOSEPH: Absolutely.
To answer your second question, I don’t have the numbers per se, and our cytopathologists are looking into this. In terms of molecular markers, we test for the same 3 that most institutions do, EGFR, KRAS, and ALK. We at this point do not triage in terms of which one gets tested first. Our cytopathologists send all the tissue together to the molecular lab, and so far we have not had any issues in terms of lack of tissue. There is currently no set protocol for this but this is something our pathology colleagues are working on.

DR DAVID C. RICE (Houston, TX): I enjoyed the presentation. Two questions. The first is that I didn’t see any mention of size of node, and size of node is 1 of the biggest things that influences your diagnostic yield. Your pretest probability was pretty high, the number of patients who actually ended up having positive nodes was high, so I suspect that we may have been talking about pretty large nodes that it probably doesn’t matter whether or not you have immediate on-site cytology; you’re going to get samples.

For lung cancer, though, there is a difference between a diagnostic EBUS and a staging EBUS, and I think, as Nirmal pointed out, now you are going more to staging. So did you look at size and see whether or not that had any effect on the initial accuracy of on-site cytology?

DR JOSEPH: Unfortunately we didn’t. We didn’t substratify according to size. The only size that we have is that in the high pretest probability they have to fulfill the criterion of at least having greater than 1 cm lymphadenopathy or PET avidity. I think we have the means to get this data to further substratify this, but it may be challenging to show a difference especially in this group of patients without a larger sample size.

Also, you are absolutely correct on the differences of a diagnostic and staging EBUS. In this particular group (high pretest probability of having cancer), there really is no utility in just a diagnostic EBUS without properly staging and so every attempt should be made to perform a staging EBUS.

DR RICE: The second question just pertains to the person who is actually reading the specimen, because the other huge thing that influences your diagnostic yield, there is tremendous variation among cytologists as to what they’re going to call adequacy of specimen, particularly when it’s tumor negative whether or not you have got lymphocytes present or not. So were there differences in who was reading the initial specimens versus who read the final ones?

DR JOSEPH: Actually, most of our preliminary diagnoses are either done by the fellow or by the attending physician, and usually they are different from the person who actually reads the final slide and cell blocks the next day, so there is some variability in that. However, the cytopathologist that reads the final pathology looks at all the slides and cell blocks, while the pathologist at the time of ROSE only looks at a portion of all the specimens, so part of the issue is that of sampling. We do have the data to look at differences between cytopathologists and initial reads at time of ROSE, which will be a better comparison and may/may not make a difference since there is a select few pathologists that make the initial reads.