Virtual Pathology: A Remote Cytology Experience

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INTRODUCTION / BACKGROUND

INTRODUCTION: Immediate interpretation by microscopic review [Rapid Onsite Evaluation (ROSE)] is a mainstay of interventional procedures for both fine needle aspiration and touch preparation of core biopsies. Rapid assessment of adequacy assists clinicians in acquiring sufficient material. Preliminary diagnoses provide for triage of materials, identification of infection, or diagnosis of high-grade neoplasms which accelerate clinical decision making.

We transitioned an affiliate hospital group from onsite general pathology staffing to subspecialized practice with diagnosis and cytology processing performed at our central location. ROSE was performed via digital review of glass slides prepared by histology staff at distant sites without the addition of cytology staff. We demonstrate that completely remote cytologic diagnosis can be done accurately for multiple sites without onsite pathologists or cytotechnologists, despite limited flexibility by clinicians, and staffing and budgetary restraints.

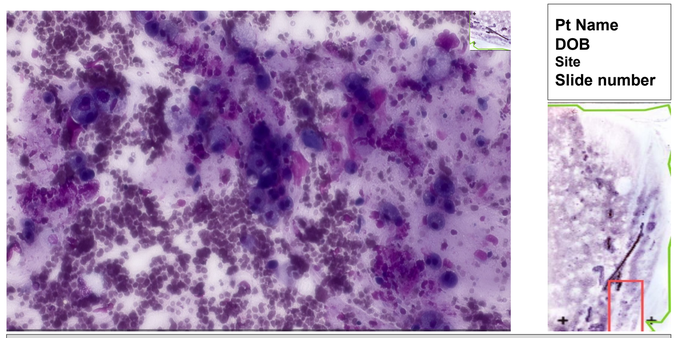
PROCEDURE: To facilitate availability, a primary pathologist was assigned to cover the remote hospitals from our home location on a week-by-week basis. The pathologist was informed of new cases by notification using a pager. Coded pages confirmed the site, the correct scanner link, and the start of the procedure. Intraprocedural communication was via Microsoft Teams. At the conclusion of each procedure, the pathologist filled out an on-site record, saved it to a shared drive and printed to the laboratory.

We used a Grundium OCUS 20X scanner with real time/ live view by a pathologist remotely guiding the system. A 2.5 X objective provides a thumbnail view. Navigation around the thumb nail view is followed by focusing on an area of interest with a higher power Live View mode

MATERIALS AND METHODS

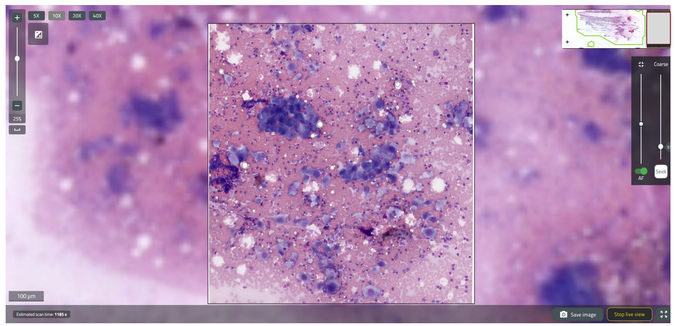
The pathology database was queried for billing codes for intraoperative touch preparation (TP, 88333 and 88334) as well as for ROSE interpretation (88172 and 88177). Final diagnosis was compared to onsite diagnosis.

Reports were reviewed and compared to scanned onsite records to ensure that procedures were reported correctly. We recorded whether the immediate interpretation was for adequacy or diagnosis, whether the result was adequate, indeterminate, or non diagnostic, and compared with final.



Screen capture of pancreatic adenocarcinoma at ROSE (l) and thumbnail of slide (r). Highlighted box shows area scanned. Most of the features of adenocarcinoma are visible:intact malignant single cells, necroinflammatory debris, and variability within groups

Total FNA	ROSE cases	Total Surgicals	Touch Prep
103	83	2275	31



Screen shot of non small cell carcinoma with live view and 10X objective. Images are clear. Identifying information on the slide is available in the thumbnail view (blocked).

RESULTS

We provided ROSE FNA for 83 of 103 FNA and ROSE TP for 31 of 2275 surgical pathology cases in our initial three-month interval. 8 FNA ROSE were discordant. 7 ROSE (4 thyroid, 2 salivary gland, 1 lung lymph node) were interpreted as nondiagnostic or indeterminant but had a benign diagnosis. 1 ROSE called non-small cell carcinoma was a small cell carcinoma. 5 TP (3 lung,1 abdomen, and 1 liver) were discordant: well differentiated neuroendocrine carcinoma missed in the liver on touch prep, and nondiagnostic ROSE-TP on an abdominal soft tissue sample and 3 lung core biopsies.

For our thyroid FNA, the primary question was one of adequacy. A diagnosis was recorded in only 1 of 49 thyroid FNA. Final diagnoses were, for the most part benign (3 non diagnostic, 39 benign, and 7 AUS). Our EBUS cases were reported for adequacy in 9 of 23 cases. 14 cases had a specific diagnosis provided. Cases reported by adequacy included 2 benign lymph node cases, 2 granulomas, 1 carcinoid tumor, 1 non-small cell carcinoma (NSCLC), 1 poorly differentiated carcinoma, 1 squamous carcinoma, and a nondiagnostic EBUS. Cases with specific EBUS diagnoses included 3 negative lymph nodes, 3 NSCLC, 2 squamous cell carcinomas, 2 lymph node cases with metastatic carcinoma, 2 small cell carcinomas, 1 adenocarcinoma and 1 poorly differentiated carcinomas. Only one EBUS had a non-diagnostic final diagnosis, it was reported as nondiagnostic on ROSE. In our first quarter, only two EUS cases utilized on site evaluation. One of two was reported as adequate, but turned out to represent sampling of kidney. The other pancreatic sample was an adenocarcinoma, interpreted as such at the time of rapid diagnosis. Touch Preparations of core biopsies were divided similarly. Adequacy only was provided for 10 of 14 liver biopsies, 4 of 9 lung biopsies, all 4 lymph node touch preparations, and 2 salivary gland touch preparations. One of two abdominal core biopsies had an intraprocedural diagnosis of atypical cells, and the other diagnosis was interpreted as adequate.

FNA/ organ	Number/ discordant	Touch Prep/ organ	Number/ discordant
EBUS	23/2	Lung	9/3
Thyroid	49/4	Liver	14/1
Salivary gland	6/2	Lymph node	4/0
Lymph node	3/0	Abd. soft tissue	2/1
Pancreas	2/0	Salivary gland	2/0

CONCLUSIONS

Accuracy of ROSE has two primary requirements: adequate images and success in identifying the cells of interest. Thumbnail views generally loaded within a minute. Screening required an adaptation of traditional techniques, as navigation at high power was not rapid enough for review of multiple slides. Our laboratory assistance was provided by the histotechnology staff on site. After some brief training sessions and some intraprocedural coaching, the quality of slides improved. One of the greatest problems was pale staining due to inadequate drying. Significant contrast is necessary for low power screening.

For many of our clients, adequacy was the end point of the diagnosis. The primary focus of the thyroid FNA (the single greatest component of our remote practice) was adequacy to reduce repeat biopsies. Cellularity was easy to assess at low power, with high power review. For the most part, under calling adequacy was a greater issue than over interpretation on FNA. Among the touch preparations, the primary issue was inadequate tissue, particularly among lung cores.

ROSE FNA and TP improve accuracy/ yield of interventional procedures and optimize triage of specimens. ROSE traditionally is done in academic centers. We argue that it provides equal or greater value in a low frequency setting. We demonstrate that expert academic level specialist consultation can be provided with reasonable accuracy at a distance for relatively low initial cost and without additional onsite staffing.

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