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1249 Variability of Hepatic Steatosis: Intraoperative vs Permanent Section Evaluation

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Disclosures: Anu Abraham: None; Hafiz Yahya: None; Neha Varshney: None

Background: The correlation of intra-operative frozen section diagnosis with the final diagnosis on permanent sections plays a significant role in evaluating liver biopsies for transplant evaluation. The purpose of this study is to investigate the discrepancy between the intraoperative frozen section and permanent section assessment of hepatic steatosis. We aim to reduce errors during frozen section interpretation as it could exclude an otherwise acceptable organ.

Design: A retrospective analysis was performed on all frozen sections performed on liver specimens in our institution between April 2017 and July 2021. A total of 264 cases were received. Out of them, 61 cases were included in the study, while 203 cases were excluded due to the concern for malignancy. We then calculated the discrepancy rate between frozen and permanent sections.

Results: Out of 61 cases, 20 (32%) cases showed discrepancies between the frozen and the permanent sections. 13 (65%) cases showed discrepancies in macrovesicular steatosis, ranging from 1-25%. Four cases (6%) showed a major discrepancy of >10%. In all cases, the percentage of macrovesicular steatosis was described more during the intraoperative consultation than the permanent section. Sixteen (80%) cases showed discrepancies in microvesicular steatosis ranging from 3-30%, and 9 (15%) cases showed a major discrepancy of >10%. Contrary to macrovesicular steatosis, microvesicular steatosis was described more in the permanent section than the frozen section in some (2/20) cases.

Conclusions: Our study found considerable discrepancies for both macrovesicular and microvesicular steatosis interpretation between frozen and permanent sections. The extent of steatosis can be misinterpreted during intraoperative consultation because of artifacts produced during frozen section due to multiple factors, including air drying quickly, water droplets freezing in the tissue during processing and much larger size of the hepatocytes with steatosis as compared to normal hepatocytes. Although a significant degree of microvesicular steatosis is not considered an absolute contraindication to transplantation, it is considered a risk factor for early hepatic dysfunction after orthotopic liver transplantation in patients with infections and other immunocompromised conditions. Awareness of these issues can help increase the diagnostic accuracy of donor liver biopsies during intraoperative frozen section interpretation.

1250 Laboratory Quality and International Laboratory (ISO15189) Accreditation - Knowledge, Attitude and Practices of Laboratory Users (Physicians) in Nigeria: A Pilot Study

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Disclosures: Ademola Adewoyin: None; Olufemi Oyedeji: None; Elizabeth Olude: None; Ann Ogbenna: None

Background: Laboratory quality ensures accurate, reliable and timely test reports, improve patient safety and reduces medical errors. Access to quality laboratory services is an indicator of effective healthcare delivery. ISO (international organization for standardization) is a leading standard-setting organization, including clinical laboratory standards (ISO15189). Laboratory accreditation is formal recognition given by an authoritative body, demonstrating competence and compliance with set standards. Very few clinical laboratories in Nigeria have international (ISO) accreditation. This study assessed knowledge, attitude and practice of physicians regarding quality standards and formal accreditation. Importance of potential factors such as laboratory accreditation status on physician choice of testing laboratory was also queried.

Design: A cross-sectional survey of registered physicians was conducted. Data on socio-demographics, physician knowledge, attitude, and practices of laboratory quality systems and international accreditation were obtained using an online survey tool. Survey instrument was shared on social media handle of the National Medical Association over a month period, after a pretest. Of the total respondents, 76 responses with complete data were analyzed. Ethical clearance was obtained from institutional review board.

Results: Most (57.9%) were physicians with practice length of 5 to 14 years. Respondents having a good knowledge and favorable attitude towards laboratory quality standards and international accreditation were 48.7% and 68.4% respectively. There is no statistically significant association between level of knowledge and attitude in relations to duration of practice, location, practice

registration and type of facility. The most important factors in physician choice of clinical laboratories include consistent reliable test reports (85.3%), clinical validations of results by pathologists (72%), access to pathologists/laboratory physicians for consultation (61.3%), turnaround time (56%), followed by international (ISO) accreditation (52%).

Variable		Frequency(%)	Knowledge Score(Mean±SD)	Attitude Score (Mean±SD)
Duration of practice, years				
	<5	6(7.9)	6.00±1.27	3.83±1.17
	5 – 14	44(57.9)	5.57±1.07	4.57±1.17
	15 – 24	20(26.3)	5.55±1.15	4.40±0.88
	>24	6(7.9)	5.67±1.37	5.00±0.63
			F=0.284, *p*=0.837	F=1.331,*p* =0.271
Location of practice				
	Lagos	58(76.3)	5.62±1.12	4.43±1.11
	Outside Lagos	18(23.7)	5.56±1.09	4.72±0.96
			F=0.047,*p*=0.829	F=1.004,*p*=0.320
Practice registration				
	General Practice	37(48.7)	5.57±1.09	4.27±1.19
	Specialist practice	39(51.3)	5.64±1.14	4.72±0.92
			F=0.082,*p*=0.775	F=3.385,*p*=0.070
Type of facility				
	Both	14(18.4)	5.21±0.89	4.07±1.64
	Government/public	30(39.5)	5.70±1.06	4.63±0.85
	Private practice	32(42.1)	5.69±1.23	4.56±0.95
			F=1.070, *p*=0.348	F=1.407,*p*=0.251
Total Mean±SD (range)			5.61±1.11 (0 – 8)	4.50±1.07 (0 - 6)

N = 76

Conclusions: Despite significant good knowledge of laboratory quality and a favorable attitude towards laboratory accreditation, formal accreditation status of a clinical laboratory is not the most important driver in physician choice of testing laboratories. Formal accreditation drive will invariably strengthen laboratory quality systems in Nigeria.

1251 The Role of Pathology Explanation Clinics as a Treatment Decision Aid for Men with Prostate Cancer

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Disclosures: Sarah Bergholtz: None; Sophia Kurnot: None; Melissa DeJonckheere: None; Todd Morgan: None; Cathryn Lapedis: None

Background: A new diagnosis of prostate cancer can lead to anxiety and distress. Compounding this distress is the fact that men must choose between active surveillance, radiation, or radical prostatectomy, all of which have similar rates of mortality, but different rates of side effects. Many men seek information to cope with this distress. There is a paucity of pathology specific information for prostate cancer patients. Pathology explanation clinics (PECs) are a unique tool whereby the pathologist meets with the patient to show them their slides and discuss the process of diagnosis. The aim of this study is to determine the value of PECs as a treatment decision aid for men with low-stage prostate cancer.

Design: Patients with a new diagnosis of low-stage prostate cancer were recruited from a tertiary care academic medical center. Semi-structured interviews were conducted before and after the PEC along with one-month and six-month follow-ups. Interviews were transcribed to conduct qualitative thematic analysis via NVivo. Semi-structured interviews following the study were completed with the involved urologic oncologists.

Results: Ten men were recruited to participate. Baseline interviews showed most men had limited understanding of their Gleason score and had feelings of anxiety and uncertainty about their diagnosis. Patients noted that PECs were a useful visual tool to improve understanding of both their specific diagnosis as well as the process of diagnosing prostate cancer. In the study

population, 60% chose active surveillance, 30% chose radical prostatectomy, and 10% chose radiation. One and six-month follow ups were resoundingly positive with a high level of satisfaction with both the PEC and their overall care team integration. Subject treatment decisions were largely driven by clinician recommendation and involvement. Overall, at one and six-month follow-up, subjects were confident in their treatment decision and had no feelings of regret. Clinicians felt that the subjects were less anxious, better prepared, and able to have more in depth conversation about prognosis and treatment at their initial consultation.

Conclusions: Overall, PECs led to improved understanding of diagnosis, reduced emotional distress, and confidence in making a high quality medical decision for men with low-stage prostate cancer.

1252 The Value of Second Opinions in Hematopathology: An Analysis of Quality and Patient Safety

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Disclosures: Catherine Bodnar: None; Steven Kroft: None; Alexandra Harrington: None

Background: Pathology second opinions in cancer diagnosis are common practice at academic centers and may lead to altered diagnoses and/or changes in patient management. Previous studies have quantified the diagnostic changes generated from second opinions for both general pathology and subspecialties but have not investigated impact on patient safety or general specimen quality. The objective of this study was: [1] to determine diagnostic error within second opinion hematopathology material from regional laboratories and [2] to ascertain the impact of suboptimal specimen collection on diagnosis and patient safety.

Design: All external, second opinion hematopathology consultation reports at our academic institution were reviewed for a 1-year period. Cases with diagnostic discordance were investigated with chart and pathology report review. Each discordant case was given 3 scores for: [1] change in diagnosis and/or clinical management; [2] harm to patient; [3] specimen/stain quality. The Vizient© Harm Score was used; quality and diagnostic scores were internally developed.

Results: During the study period, 877 second opinion hematopathology consultations were reviewed, of which 33 (3.7%) had discordant diagnoses in 17 bone marrows and 16 tissues across 14 myeloid and 19 lymphoid diagnoses. Forty-five percent of discordant cases underwent consensus diagnosis. Upon internal review, 9 cases went from benign to malignant, 5 from atypical to malignant, and 8 cases received different subclassification. Of discrepant cases, 12 revisions resulted in a change in diagnosis but no change in management; 6 cases led to a definitive change in diagnosis and management. Of these 6 cases, half had time delays, with a revised diagnosis reached after therapy commencement. Most cases had no quality issues identified (N=23; 70%). Ten discrepancies had quality issues affecting interpretation, including 4 (12%) requesting a new biopsy, 3 cases (9.1%) with poor staining quality, and 2 inadequate lymphoma staging/grading specimens. Approximately 2/3 of discordant cases had a negligible harm score; 11 cases (33%) had a harm score in which diagnostic discordance led to additional treatment and/or procedures.

Conclusions: A minority of hematopathology second opinions at our institution have discrepant diagnoses from the original interpretation, though almost 1/2 were upgraded to a malignant diagnosis and 1/3 resulted in additional treatment or procedures- highlighting the value of the second opinion process.

1253 Tumor Stage by Size and Pathologist in Clear Cell Renal Cell Carcinoma from Synoptic Reports: Estimating Rates by Tumor Size and a Case for Mandated Reviews

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Disclosures: Michael Bonert: *Stock Ownership*, Libre Pathology Ltd.; Nikfar Nikzad: None; Ihab El-Shinnawy: None; Samih Salama: None; Anil Kapoor: None

Background: Clear cell renal cell carcinomas (ccRCC) are predominantly pT1a and pT3a; however, consensus rate benchmarks by tumor size for quality management remain to be established. Locally, a relative pT2a/b over-call was identified in 2017. Subsequently, a grossing defect was corrected, and the yearly tumor staging rates by size for ccRCCs were followed.

Design: All in house ccRCC resections at a regional centre accessioned 2013-2020 with synoptic reports were retrieved. Tumor stage was stratified by the size cut-offs (4 cm, 7 cm, 10 cm) and the pathologists that saw >60 ccRCC cases each.

Results: The cohort had 1,320 RCC resections of which 912 were ccRCC. By tumor stage they were 43% (393 cases) pT1/pT1a, 20% (181) pT1b and 30% (276) pT3x+pT4. The raw yearly pT2a/b rates for >7 cm ccRCCs varied from 40% to 11.5% without a clear trend over time, and could not be reconciled with the published literature (see Table 1). Benchmark rates were estimated from Taneja *et al.* using the formula: [T stage prevalence by Taneja *et al.*] / ["prevalence of size bracket" in the current study] and compared to Bonsib. At least three sections were taken from the renal sinus in 18 of 19 pT2a/b cases after 2017. Seven pathologists saw >60 ccRCC cases each (range: 61-104) and collectively saw 566 cases; their pT2a/b rate for ccRCCs >7cm was 27% (range: 0% to 41%). The pT2a/b rate range and high pT2a/b rate led to the institution of mandatory reviews for all pT2a/b ccRCCs (going forward) by a genitourinary pathologist.

Table 1: Clear Cell Renal Cell Carcinoma Stratified by Tumor Stage and Tumor Size

Size	Current Study (n=912)				Literature - Benchmarks	
	Number of Cases	Prevalence of Size Bracket	Cases Staged by Size Criterion	Percent Staged by Size Criteria	Percent Staged by Size – Bonsib (n=120)	Est. Percent Staged by Size – based on Taneja *et al.* (n=165)
Unknown Size	3	0.3%	NA	NA	-	-
>0 cm & <=4 cm	431	47.3%	392	91.0%	85%	78.9%
>4 cm & <=7 cm	268	29.4%	180	67.2%	32%	36.6%
>7 cm & <=10 cm	145	15.9%	49	33.8%	3%	6.4%
>10 cm	65	7.1%	9	13.8%	0%	0.0%
Sum	912	100.0%	630	69.1%	-	-

Conclusions: Analysis of the tumor size in relation to the stage may identify staging issues. Consensus benchmarks for (1) the pT2a/b rate for > 7cm ccRCCs, and (2) the pT1b rate for >4cm and <=7 cm ccRCCs, would be useful for the quality management of RCC tumor staging. Due to the relatively rarity, mandated reviews of pT2a/b ccRCCs may be broadly advisable in environments without subspeciality sign-out.

1254 Repeat Biopsies for Rectal vs. Non-Rectal Adenocarcinoma: Are We Hedging on Rectal Biopsies?

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Disclosures: Rupinder Brar: None; Luz Sullivan: None; Mustafa E Arslan: None; Michel Kmeid: None; Neharika Shrestha: None; Anne Chen: None; Hwajeong Lee: None

Background: Patients with rectal cancer undergo more repeat biopsies compared to those with non-rectal cancer prior to management. This may be due to 1) pathologists' reluctance to diagnose malignancy on a rectal biopsy, 2) histologic characteristics of tumor, 3) unavailability of pertinent colonoscopy/imaging data at the time of biopsy interpretation, or 4) surgeons'/oncologists' obligation to confirm the malignancy by tissue biopsy prior to management.

Design: Archived H&E slides from 55 rectal adenocarcinoma patients (study group: 64 biopsies and 56 resections) and 57 non-rectal colon adenocarcinoma patients (control group: 57 biopsies and 57 resections) were retrieved. The biopsies were reviewed for sample size, benign tissue (%), low grade dysplasia (LGD), intramucosal carcinoma (IMC), desmoplasia (%), inflammation and additional H&E levels. The resections were reviewed for tumor grade, tumor budding, tumor-stroma ratio, mucosal involvement without desmoplasia, and tumor surface desmoplasia and inflammation. Data on demography, intradepartmental consultation, colonoscopic findings, imaging and outcome of the diagnosis (repeat biopsy, neoadjuvant therapy, resection) were recorded from the electronic medical record. Association of significance was defined as $p<0.05$.

Results: Repeat biopsy, including surgeon's biopsy in the operating room (OR), was more common in the study group than the control group (p<0.05). OR biopsy was larger with a better diagnostic yield than endoscopic biopsy (p<0.05). Biopsy was repeated for those who subsequently received neoadjuvant therapy (p=0.02). These patients were younger and had tumor located in the lower 2/3 of the rectum with higher T stage (p<0.05). In the control group, patients with non-diagnostic biopsy underwent resection without a repeat biopsy. The diagnostic yield, sample size, amount of benign tissue/desmoplasia, LGD, inflammation, levels, intradepartmental consultation, availability of colonoscopy report at the time of biopsy interpretation and tumor characteristics on resections did not differ between the two groups. IMC was less common in rectal biopsies than controls, however did not affect the diagnostic yield.

Table 1.

	Study group	Control group	p-value
Number of patients	55	57	
Mean age (range), years	64.4 (38-88)	66.2 (28-93)	NS
Male: female	34:21	31:26	NS
Colonoscopy available, %	93.8	100	NS
Mass on colonoscopy, %	83.3	93.0	NS
Staging work-up available, %	23.4	56.1	0.0003
Levels done on biopsy, %	18.8	26.3	NS
Intradepartmental consultation, %	25.0	31.6	NS
Mean % of benign tissue in biopsy	26.7	23.2	NS
Mean % of desmoplasia in biopsy	25.6	28.5	NS
Low grade dysplasia in biopsy, %	42.2	36.8	NS
Intramucosal carcinoma in biopsy, %	81.3	100.0	0.0003
Inflammation in biopsy, %	68.8	57.9	NS
Malignancy not confirmed on biopsy, %	21.9	28.1	NS
Led to repeat biopsy though initial biopsy could have been diagnostic	3/23	0/16	NS
Biopsy in operating room by surgeon, %	26.1	1.8	0.0001
Repeat biopsy (patients), %	32.8	0	<0.05
Outcome following repeat biopsy (diagnostic)	Neoadjuvant=11, Oncologic resection=2	NA	
Outcome following repeat biopsy (non-diagnostic)	Neoadjuvant=3 Transanal excision=2	NA	
Neoadjuvant therapy, %	46.4	5.3	0.00001
T stage (1/2, 3/4)	18, 38	13, 44	NS
*Tumor grade, low grade, %	93.1	88.9	NS
* Resection tumor budding, 2 to 3, %	36.7	22.2	NS
Resection tumor-stroma ratio, stroma-high, %	52.3	41.1	NS
*Mucosal involvement without desmoplasia, %	79.3	87.0	NS
*Resection with >50% surface desmoplasia, %	50.0	35.2	NS
*Resection with >50% tumor surface inflammation, %	28.6	25.9	NS

NSNS: p>0.05, *S/P neoadjuvant excluded: p>0.05, *S/P neoadjuvant excluded

Conclusions: Repeat biopsy of rectal cancer is primarily driven by management implications. Pathologists' approach to biopsy and diagnostic yield remained consistent irrespective of tumor site. For rectal tumors, a multidisciplinary strategic approach may be warranted to avoid repeat biopsy when unnecessary.

1255 Should We Perform Germline Genetic Testing on Men with Prostate Cancer with Intraductal and Cribriform Histology?

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Background: Updated NCCN guidelines recommend germline testing for patients (pts) whose prostate cancer (PCa) display intraductal (IDC)/cribriform (CRIB) histology regardless of age and family history. This is based on limited and conflicting data

suggesting that these tumors are more likely to harbor germline gene mutations. Herein, we assess the impact of expanded NCCN guidelines in relation to IDC/CRIB histology on our current institutional practice for germline testing in pts with PCa.

Design: This retrospective study includes 725 pts diagnosed with PCa on core biopsy between Feb 2021 and Sept 2021. Of note, we initiated routine reporting of presence or absence of IDC/CRIB features in pathology reports only since Feb 2021. Age, ethnicity, personal and family history, Gleason score, IDC/CRIB features, prostatectomy and germline testing status were recorded (Table 1). Additional cost of genetic testing strategy based on IDC/CRIB histology was calculated.

Results: Of 725 pts, 527(73%) pts showed Gleason pattern 4 disease and 157(22%) had IDC and/or CRIB histology reported: CRIB pattern was present in 145/157(92%) pts and IDC in 91(58%) pts either on core biopsy or following prostatectomy. Median age of pts with IDC/CRIB PCa was 67y (47-84y). Race distribution was as follows- 110(70%) Caucasian, 32(20%) African-American and 15(10%) unknown. Prostatectomy was performed in 51/157(32%). Twenty-five (16%) showed metastatic disease on staging. Of 157 pts, 39(25%) were referred for genetic counseling- 18 with metastasis and/or 31 with strong family history of cancer. Germline testing was performed in 15/39(38%)- 2(13%) with positive results for CHEK2 or HOXB13 mutations; 9(60%) with negative results; 4(27%) results are still pending. Of note, IDC/CRIB morphology in isolation was not used as a criterion for genetic counselling referrals in our practice. With new guidelines, 118(16%) additional pts would have been eligible for germline testing based on the IDC/CRIB features alone. Assuming the average cost for multigene testing (4,000$) coupled with cost of genetic counseling (250$), this would constitute an added monetary burden of 501,500$ plus the cost for cascade testing.

Table 1.
Characteristics of patients with prostate cancer with intraductal and cribriform histology (n=157)

Age at diagnosis	
Median, year (range)	67 (47-84)
Ethnicity	
Caucasian	110 (70%)
African American	32 (20%)
Unknown	15 (10%)
Highest Gleason score	
3+4	46 (29%)
4+3	41 (26%)
4+4	13 (8%)
5+3	2 (2%)
4+5/5+4	49 (31%)
5+5	5 (3%)
Pure intraductal carcinoma	1 (1%)
Intraductal histology (IDC)	
Yes	91 (58%)
No	66 (42%)
Cribriform histology (CRIB)	
Yes	145 (92%)
No	12 (8%)
Node involvement	
N0	149 (95%)
N1	8 (5%)
Metastasis at staging	
M0	140 (89%)
M1	17 (11%)
Strong family history of cancer (breast, prostate, colorectal, pancreatic, gastric, lung, urothelial, melanoma)	
Yes	31 (20%)
No	126 (80%)

Conclusions: Incorporation of IDC/CRIB histology in the NCCN guidelines for germline testing in PCa significantly adds to cost of care and puts an overwhelming pressure on limited genetic counseling services. More studies examining the association of IDC/CRIB histology with hereditary PCa are needed to justify these recommendations.

1256 Retrospective Analysis of Factors Associated with Repeat Testing Outcome for an NGS-Based NTRK Fusion Assay: A Quality Improvement Project

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Disclosures: Alessia Buglioni: None; Cristiane Ida: None; Adam McClung: None; Angela Tauscher: None; Kristin Leveque: None; Ann Moyer: None; Gang Zheng: None

Background: In 2018, the FDA approved the first pan-cancer drug targeting fusions involving neurotrophic tyrosine receptor kinase (NTRK) genes *NTRK1, NTRK2* and *NTRK3*. *NTRK* fusions can be detected through RNA-based next-generation sequencing (NGS) using formalin-fixed paraffin-embedded (FFPE) specimens. However, NGS using FFPE-derived RNA can present high repeat and failure rate due to RNA degradation and chemical modification. A quality improvement effort was initiated in our Laboratory to systematically analyze factors associated with repeat testing, to reduce the repeat rate of our RNA-based *NTRK* NGS assay.

Design: Retrospective analysis was performed for all samples tested for *NTRK* fusion by an in-house RNA-based targeted NGS assay, at our Institution, in the last year. The reason for repeat testing was analyzed. When the reason for repeating was sample quality, we further looked at whether repeat testing was performed on re-extracted RNA, the RNA concentration measured, and what the RNA quality metrics were (RNA 260/280 and 260/230 ratios).

Results: A total of 591 samples were analyzed between 2020 and 2021. The main reason for repeat testing was sample-related quality (25.7%, 152/591). Other causes included testing processing-related factors such as robot failure (3.9%, 23/591) and control failure (3.0%, 18/591), result confirmation (1.5%, 9/591) and others. Further analysis was focused on the repeat testing due to sample-related quality. Among 75 repeated samples without RNA re-extraction, only one (1.3%) was successful. Among 78 repeated specimens with RNA re-extraction, 46 (59%) were successful ($p<0.001$ by chi-square analysis). A strong correlation between RNA concentration during repeat testing and the repeat testing outcome was observed: cases with <30 ng/ul were rarely successful ($p<0.001$ by ROC analysis, Figure 1). RNA 260/280 ratio also correlated with repeat testing outcome: a ratio <1.74 always failed repeat testing ($p<0.001$ by ROC analysis, Figure 2).

Figure 1 - 1256

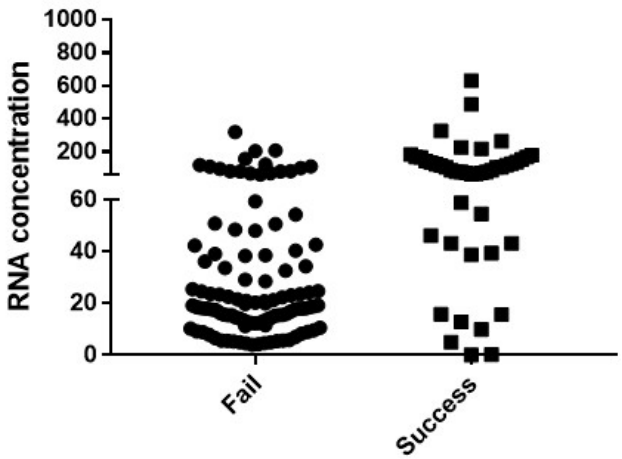
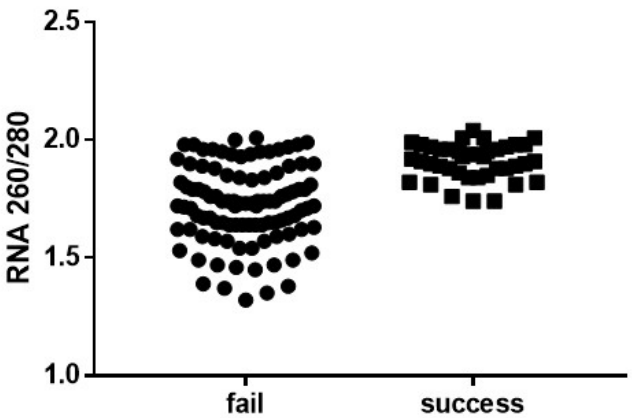


Figure 2 - 1256



Conclusions: In our experience, FFPE samples undergoing RNA-based *NTRK* NGS should be repeated only if the sample is re-extracted, the RNA concentration >=30 ng/ul, and the RNA 260/280 ratio >=1.74. These quality improvement measures are estimated to reduce >50% of repeat testing in our practice and are predicted to result in substantial resources and cost saving.

1257 Evaluation of the Global Supply of Pathologists

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Disclosures: Andrey Bychkov: None; Junya Fukuoka: None

Background: The WHO estimated that there are 13.2 million medical doctors worldwide in 2021. It is supposed that pathologists account for 0.5-1% of all physicians. There is a growing number of reports from different countries claiming a shortage of pathologists, an increasing workload, and projecting a potential workforce crisis in the near future, which could negatively impact patient care. At this time, there is no global registry of pathologists available, which would allow for assessing a full picture of the pathologist workforce on a global scale. This study attempted to access and summarize the worldwide supply of pathologists.

Design: Data were collected from national registries with the help of the local pathologists, from publications in international and local journals, and via communication with local societies. When possible, this information was validated by personal communication with pathologists from their respective countries. Data on physicians were drawn from the WHO report (2021).

Results: Currently, there are approximately 83,500 pathologists in 93 countries representing 90% of the world population. Pathologists account for 0.8% (95% CI: 0.6-0.9%) of physicians. Number of pathologists correlated with number of physicians in a country ($r = 0.76$; $p < 0.01$). The top 5 countries with the highest number of pathologists are the USA (25%), China (13%), India (5.5%), Brazil (4.2%), and Russia (4%). Ten countries accounted for 2/3 of the pathologist workforce. The density of pathologists per 1M population is 12.5 worldwide, 48.8 in North America, 26.1 in Europe, 17 in South America, 6.8 in Asia, and <4 in Africa. Considering North America with 50 pathologists per 1M as a model, there is a significant (4x less than needed) shortage of pathologists on a global scale, with a moderate lack in Europe, severe lack in Asia, and extremely severe shortage in Africa. Data collection revealed considerable heterogeneity in local registries' recording of pathologists, such as inclusion/exclusion of clinical pathologists, residents, retired and semi-retired pathologists, and more.

Conclusions: This is the first contemporary report on the global workforce of pathologists. There is a significant international imbalance of pathologists' supply with a different degree of shortage. These data can be of help for the local and international communities of pathologists and serve as baseline numbers for geographic and temporal comparisons and future projections.

1258 Rates and Sources of Discordance Between Frozen Section and Final Diagnoses of Ovarian Epithelial Neoplasms

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Disclosures: Eleanor Castro: None; Jon Marsh: None; S. Joshua Swamidass: None; Lulu Sun: None

Background: Adnexal masses are very common, but if clinical assessment cannot exclude malignancy, surgical exploration is required. During the surgery, intraoperative frozen section analysis can provide a diagnosis. This is essential in determining if aggressive surgical staging is necessary, but is subject to error. We sought to determine the error rate and sources of error in frozen section diagnoses of ovarian epithelial neoplasms at our institution.

Design: With IRB approval, reports from primary ovarian serous and mucinous neoplasms that were evaluated by frozen section from January 2019 to June 2021 were retrieved. The frozen and final diagnoses were evaluated for discordance in: i) level of proliferation/invasion (benign, borderline, malignant) and ii) histologic subtype (mucinous, serous, etc). Discordant case slides were reviewed by a gynecologic pathologist to determine whether there was sampling or interpretive error. The proportion of discordant cases reviewed by gynecologic subspecialty versus non-subspecialty pathologists at the time of frozen section was compared using the Fisher exact test.

Results: Of the 297 cases retrieved, 22 cases (7.4%) were not given an informative diagnosis of benign, borderline, at least borderline, or malignant (Table 1). In the remainder, 7.2% of cases were discordant. All of these had a benign or borderline frozen section diagnosis, and were all upgraded to either borderline or malignant status, including 3 benign cases that were upgraded to a malignant neoplasm. 50% were due to sampling errors, while 50% were due to interpretive errors. For histologic subtype, 46 cases (15.3%) were deferred or not specified, and in the remainder, 7.6% of cases were discordant. The majority (68.4%) of these were

due to interpretive difficulties. There was no statistical difference in discordance rate in subspecialty versus non-subspecialty frozen section pathologists for either benign/borderline/malignant status (6.7% versus 8.1%, respectively) or histologic subtype (5.7% vs 7.5%, respectively).

Table 1. Rate and sources of discordance in benign/borderline/malignant status of mucinous and serous ovarian neoplasms

			Discordant Cases			
Frozen Diagnosis	**N (% of Total)**	**Discordant (%)**	**Upgraded (%)**	**Downgraded (%)**	**Sampling Error (%)**	**Interpretive Error (%)**
Benign	181 (60.9)	16/181 (8.8)	16/16 (100.0)	0/16 (0)	7/16 (43.8)	9/16 (56.3)
Borderline	32 (10.8)	4/32 (12.5)	4/4 (100.0)	0/4 (0)	3/4 (75.0)	1/4 (25.0)
"At least " borderline	23 (7.7)	0/23 (0)	N/A	N/A	N/A	N/A
Malignant	39 (13.1)	0/39 (0)	N/A	N/A	N/A	N/A
Defer to final/not specified	22 (7.4)	N/A	N/A	N/A	N/A	N/A
Total	297 (100.0)	20/275 (7.2)	20/20 (100.0)	0/20 (0)	10/20 (50.0)	10/20 (50.0)

Conclusions: While the overall error rate in frozen section evaluation of ovarian neoplasms is low, there are a considerable number of cases not given an informative diagnosis, and a few misdiagnoses with significant implications for the patient. Future research could investigate the use of computer-aided techniques such as artificial intelligence image analysis to provide more accurate diagnoses.

1259 Quality Assurance Review of Specimen Characteristics Obtained by Core Needle Biopsy and Fine Needle Aspiration of Pancreas

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Disclosures: Carlos Castrodad-Rodríguez: None; Kevin Kuan: None; Preeti Malik: None; Rema Rao: None; Shweta Gera: None; Amarpreet Bhalla: None

Background: The standard of care for pre-operative diagnosis of pancreatic lesions involves endoscopic ultrasound (EUS) guided fine needle aspiration (FNA) and/ or core needle biopsy CNB). CNB is an evolving procedural technique and its diagnostic and procedural efficacy has been evaluated in a few studies previously. This study aims to compare the diagnostic yield, efficacy and limitations for each of the techniques at a tertiary care setting.

Design: A retrospective search for patients who underwent CNB only or both FNA and CNB for pancreatic lesions during years 2018 to 2021 was performed. Fifty patients were identified of which 41 underwent FNA either concurrently with CNB or within a year. Clinical, radiological, and pathological parameters were recorded. Independent blinded review of the glass slides was performed by three board certified pathologists trained in both surgical pathology and cytopathology. Diagnostic accuracy was calculated as a sum of true positives and true negatives divided by the number of total cases.

Results: Diagnostic accuracy of CNB and FNA for identifying neoplastic lesions was 66% and 85% respectively, while for adenocarcinoma was 64% and 85% respectively. Both CNB and/or FNA identified a majority (25/28) of the neoplastic lesions. Tumor cytoarchitecture including glandular, solid, and papillary forms was better appreciated in core needle biopsy (51%), while only 34% cases revealed glandular features on FNA. Single cells and small clusters were noted more on FNA (37%) versus CNB (8%). 62% of all CNB and 22% of cytology specimen were inadequate for evaluation. Blood clots obscured the CNB specimen in 49% and FNA in 46%. 19% of CNB were fragmented, 19% were partially viable, while 8% showed crush artifact. 46% of FNA specimen revealed blood clots, 22% showed inflammation and 10% revealed significant gastrointestinal contamination. Preparation artifacts were present in 27% of FNA specimen. 16% of CNB and 20% of cytology cases were adequate for molecular testing.

CNB (n=9)			
CNB diagnostic category	***Total Number***	***Final Pathologic diagnosis***	
Positive	2	Adenocarcinoma (2)	
Suspicious	1	Adenocarcinoma (1)	
Nondiagnostic/ negative	6	Cystic lesions (2) IgG4 disease (2) WDNET (1) Acute pancreatitis (1)	
CNB and FNA (n=41)			
CNB diagnostic category	***FNA diagnostic category***	***Total Number***	***Final Pathologic diagnosis (n)***
Positive	Positive	6	Adenocarcinoma (4)
			WDNET (1)
			DLBCL (1)
Suspicious	Positive	4	Adenocarcinoma (4)
Atypical	Positive	7	Adenocarcinoma (6)
			WDNET (1)
Positive	Atypical	3	Adenocarcinoma (2) Diffuse large B cell lymphoma (1)
Non diagnostic	Positive	1	Adenocarcinoma (1)
Non diagnostic	Suspicious	1	Adenocarcinoma (1)
Atypical	Non diagnostic	1	Adenocarcinoma (1)
Non diagnostic	Atypical	7	Mantle cell lymphoma (1)
			IgG4 (2)
			Undetermined (2)
			Cyst (2)
			Reactive (1)
Atypical	Atypical	2	Autoimmune pancreatitis (2)
Atypical	Negative	1	IgG4 disease (1)
Negative	Atypical	1	Cystic lesion (1)
Non diagnostic	Non diagnostic	7	Cystic lesion (4)
			Autoimmune (1)
			IgG4 disease (1)
			Undetermined (1)

Figure 1 - 1259

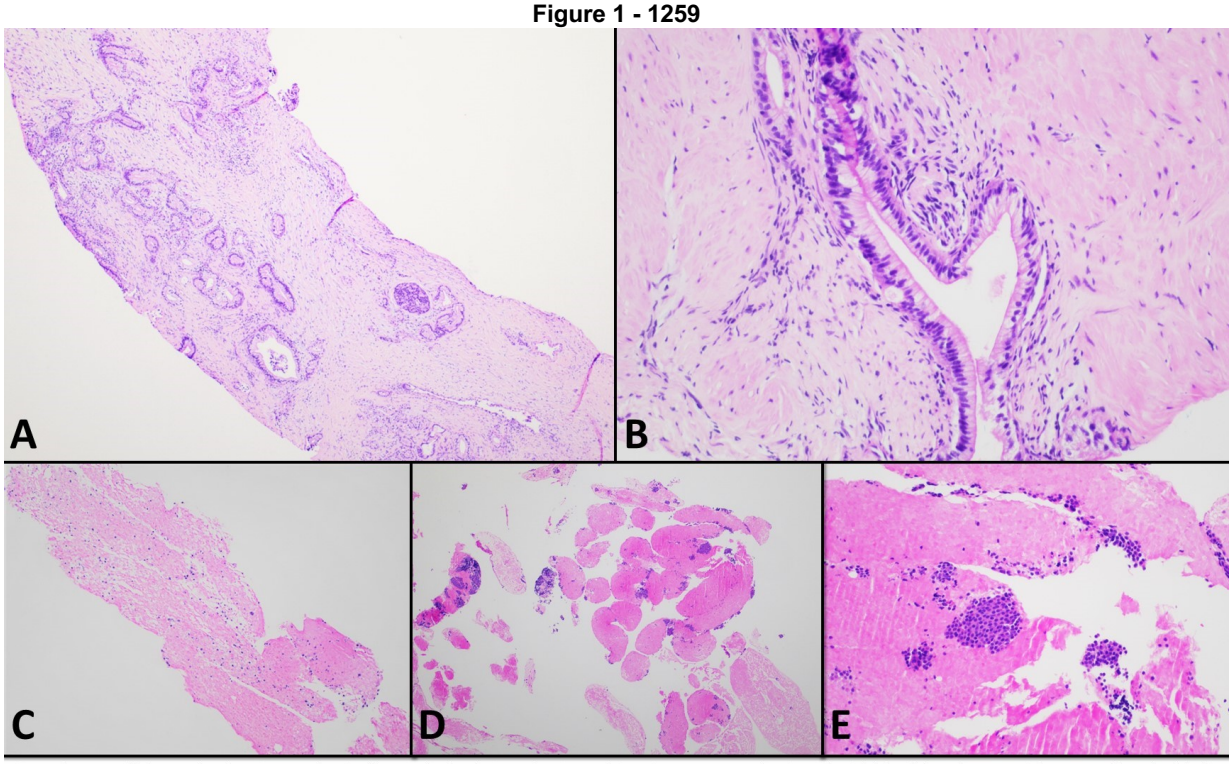

Fig. 1a,b. CNB with foamy gland carcinoma showing low grade dysplasia and perineural invasion 1c. CNB predominantly with blood clot 1d,e CNB with tumor cells embedded in blood clot, without stromal interface.

Figure 2 - 1259

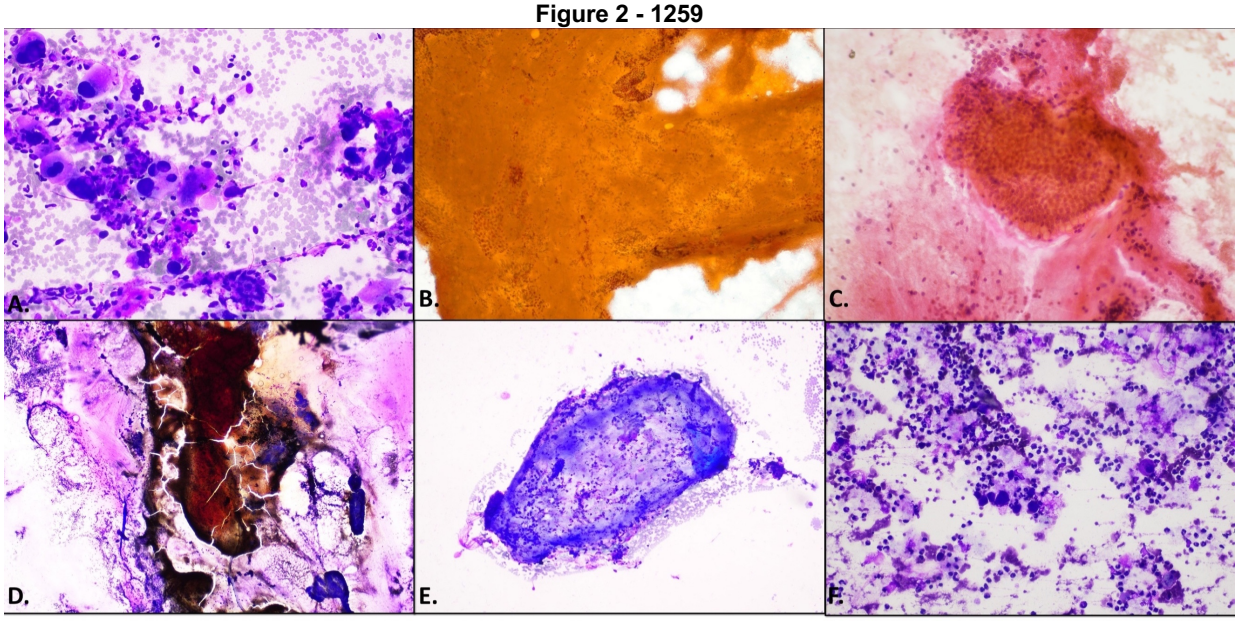

Fig. 2. FNA cytology specimen with: A. High grade cytologic dysplasia seen in 29% cases, B. blood clots, C. GI contamination, D. Preparation artifact, E. mucin and inflammation; F. Necrosis and abscess

Conclusions: Both CNB and FNA had similar limitations but FNA seems to have a better overall diagnostic accuracy and yield than CNB for identifying neoplasms, especially adenocarcinoma. CNB were helpful for appreciation of the tumor cytoarchitecture, especially in cases of low-grade/ well-differentiated tumors. Specimens obtained by core needle biopsies may be sent to Cytology for processing and cell block preparation to enhance the yield of single cells from the specimen.

1260 A Quality Analysis of Bony Specimens for Optimal EDTA Decalcification

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Disclosures: Jonathon Craig: None; Michelle Freeman: None; Schaundra Walton: *Employee*, Vanderbilt University Medical Center; Mitra Mehrad: None; Jennifer Gordetsky: *Consultant*, Jansen

Background: Decalcification is an essential process that is less understood than formalin fixation. Acidic solutions are mainstay of the decalcification process, facilitating rapid decalcification, but at the expense of molecular integrity. Weak acids, such as etheylenediaminetetraacetic acid (EDTA) chelate calcium ions from the surface of tissues, decalcifying tissue on a slower scale and preserving molecular structures for ancillary testing. Strictly defined protocols exist for the use of strong acids but protocols for EDTA are largely based on experience. We studied the effects of EDTA on different types of bony specimens for quality assurance.

Design: Bony specimens were taken from lower extremity amputations, including curettage (n=5) from the proximal femur, containing 0.7 g of medullary and small fragments of cortical bone. Fibula proximal shaves (n=5), 1 mm thick, 0.5 g. Tibia proximal shaves (n=5), 2 mm thick, 0.9 g. Blocks were fixed in 10% buffered formalin for 24 hours and then placed in 20:1 concentration of EDTA (Newcomersupply, WI, USA) with continuous stirring. EDTA was changed every 24 hours and specimens removed at 24, 48, 72, 96, and 120 hours. An additional tibia section remained in EDTA for 168 hours. X-ray imaging (Kubtec Xpert 40) was obtained following removal from EDTA. Blocks were sent for routine histological processing, and sections attempted. If unsuccessful, surface decalcification with 1% hydrochloric acid was performed in increments of 15 minutes, up to one hour, and sections were again attempted.

Results: X-ray imaging of curettage specimens shows loss of visible calcium in medullary bone at 48 hours. Fibula and tibia sections showed progressive decrease in calcification of cortical bone, with loss of hyperintense foci at 96 and 168 hours, respectively. Curettage sections could be obtained at 96 hours without surface decalcification and at 48 hours with 30 minutes of surface decalcification. Fibula sections could be obtained without surface decalcification at 120 hours but not earlier even with surface decalcification. Tibia sections were obtained at 168 hours with one hour of surface decalcification.

Figure 1 - 1260

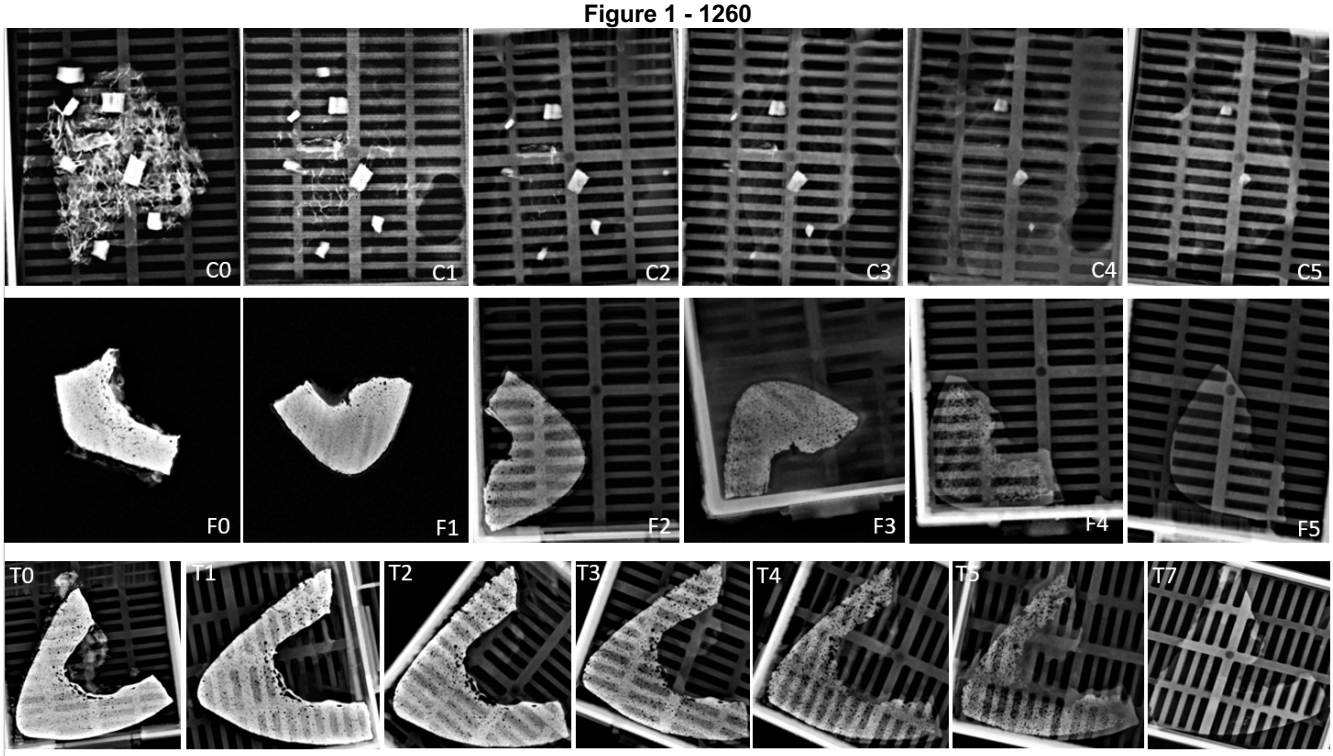

Figure 1: Different types of bony specimens (C-curettage, F-fibula, T-tibia) and the number of days spent EDTA at the time of x-ray.

Conclusions: X-ray imaging can determine appropriate decalcification for histologic processing. Medullary bone undergoes more rapid decalcification in EDTA than cortical bone. EDTA decalcification is appropriate for curettage specimens, which often require additional molecular testing. EDTA is inefficient for larger cortical bone specimens.

1261 Chromogenic In Situ Hybridization for High Risk Human Papillomavirus RNA in Fine Needle Aspiration Samples of Metastatic Oropharyngeal Squamous Cell Carcinoma

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Disclosures: Igor Damasceno Vidal: None; Diana Lin: *Consultant*, Proteocyte; Isam Eltoum: None; Manuel Lora Gonzalez: None

Background: High risk human papillomavirus (HPV)-associated oropharyngeal squamous cell carcinoma (OPSCC) is now the most common cancer caused by HPV. HPV-OPSCC typically presents as metastasis to cervical levels II-IV diagnosed by fine-needle aspiration (FNA) with occult primary. Tumor HPV status at the time of diagnosis has management and prognostic implications and points to oropharyngeal primary in carcinoma of unknown primary (CUP). This study aims to validate HR-HPV ribonucleic acid by in situ hybridization (HR-HPV RNA ISH) for use in cell block (CB) material from FNA.

Design: A search was conducted in the cytopathology department files for positive cervical lymph node FNAs with the corresponding OPSCC in surgical specimens from 2018-2021. Cases with cytology diagnoses of atypical, suspicious for SCC and SCC with corresponding surgical tissue were included. HPV-OPSCC was defined as p16 or HR-HPV RNA ISH positivity in resection. CB with at least one tumor nest was selected for validation of HR-HPV RNA ISH. A minority of resections with unknown final HPV status will be tested for confirmation.

Results: 60 FNAs positive for metastatic OPSCC were identified among 207 neck FNA reports, of which 39 (65%) corresponded to HPV-OPSCC, 14 (23.3%) to HPV-negative OPSCC, and 8 (13.3%) were OPSCC with unknown HPV status. 42 (70%) patients presented as CUP. 66.7% of metastases were cystic. The table summarizes the clinicopathologic characteristics of the cases.

Table 2. Characteristics of the samples and distribution of lesional material.

Cytology diagnosis		Tumor cellularity in cell block					Highest tumor cellularity in smears					Distribution of lesional material			
		<1%	1-25%	26-50%	51-75%	>75%	<1%	1-25%	26-50%	51-75%	>75%	Smear	Cell block	Low on both	Relatively equal
Squamous cell carcinoma (SCC)	49 (81.7%)	17	18	9	1	4	2	11	10	13	10	31	6	2	10
Suspicious for SCC	7(11.6%)	7	0	0	0	0	3	3	1	0	0	4	0	3	0
Atypical	4 (6.7%)	4	0	0	0	0	4	1	0	0	0	1	0	3	0
	60 (100%)	28	18	9	1	4	9	15	11	13	10	37	6	8	10
		46.7%	**30%**	**15%**	**1.6%**	**6.7%**	**15%**	**25%**	**18%**	**22%**	**17%**	**62%**	**10%**	**13%**	**17%**

Conclusions: HR-HPV RNA ISH is an HPV-specific test that does not require a cut-off and is interpreted as positive or negative. While current guidelines recommend p16 immunohistochemistry as the best initial test in surgical specimens, several studies have debated reliability of p16 staining in cytology, mainly for two reasons: 1) many samples are cystic and yield low cellularity, and 2) it has been difficult to establish a reproducible p16 positivity cut-off. Application of HPV-specific methods in cytology may return cost and time-efficient benefits in diagnosis and management of OPSCC and CUP. HR-HPV RNA by ISH should be validated before application in cytology specimens.

1262 Assessing the Utility of Lymphoma Work-Up for Axillary Lymph Node Core Biopsies

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Disclosures: Carl Dernell: None; Abraham Bogachkov: None; Shelly Reimer: None; Anubha Wadhwa: None; Shadie Majidi: None; John Astle: None; Julie Jorns: None

Background: Pathologic evaluation of lymph node tissue routinely involves touch preparations when there is reasonable likelihood of hematologic malignancy. Findings on touch preparations, in conjunction with clinical suspicion, determine performance of flow cytometry and assignment to a hematopathology or surgical pathology service. Many specimens processed in this manner include axillary lymph node core biopsy (AxLNCB) triggered by breast cancer screening. Our objective was to determine whether AxLNCB specimens (or a subset) identified via breast cancer screening warrant lymphoma workup.

Design: AxLNCB specimens from 1/2019 to 6/2021 from our enterprise (1 academic and 2 community hospital sites) were evaluated, for a total of 549 cases. Clinicopathologic features were assessed by chart and slide review, with detailed breast imaging review in process.

Results: Patients were predominantly female (508/549; 92.5%) with mean age of 56.9 years. Of 549 AxLNCB, 336 (61.2%) were benign, 160 (29.1%) contained metastatic carcinoma, 49 (8.9%) hematologic malignancy, 3 (0.6%) metastatic melanoma, and 1 (0.2) metastatic sarcoma.

In benign lymph nodes, no specific histology (216/335; 64.5%) and reactive follicular hyperplasia (57/335; 17%) were the most common findings. CLL/SLL was the most common hematologic malignancy (21/49; 42.9%) (Table 1).

Lymphoma work-up was performed in 273 (49.7%), with flow cytometry in 232 (42.3%). Of 282 patients with either concurrent (233/549; 42.4%), recent (within 2 years of surgery) (14/549; 2.6%) or remote (>2 years) (35/549; 6.4%) breast cancer, 43 underwent lymphoma workup (15.2% of breast cancer patients, 15.8% of patients undergoing lymphoma workup), with only 2 resulting in hematologic malignancy. Of the 49 cases with hematologic malignancy, flow cytometry was considered a critical part of making the diagnosis in just one case.

Table 1 - Axillary lymph node core biopsies without metastatic carcinoma

Hematologic Malignancy Classification (N=49)	**N (%)**
Chronic lymphocytic leukemia/small lymphocytic lymphoma (CLL/SLL)	21 (42.9)
Large B-cell lymphoma/diffuse large B-cell lymphoma	13 (26.5)
Follicular lymphoma	5 (10.2)
Mantle cell lymphoma	3 (6.1)
Classic Hodgkin lymphoma	2 (4.1)
Anaplastic large cell lymphoma	1 (2.04)
CD5(+) B-cell lymphoma not otherwise specified	1 (2.04)
Marginal zone lymphoma	1 (2.04)
Plasma cell neoplasm	1 (2.04)
Peripheral T-cell lymphoma not otherwise specified	1 (2.04)
Benign Lymph Node Histology (N=336)	**N (%)**
No specific findings	216 (64.3)
Reactive follicular hyperplasia	57 (17.0)
Dermatopathic changes	23 (6.8)
Tattoo pigment	19 (5.6)
Non-caseating granulomas	14 (4.2)
Polytypic plasmacytosis	4 (1.2)
Silicone lymphadenopathy	1 (0.3)
Necrotic tissue	2 (0.6)

Conclusions: Lymphoma workup, including touch preparations and flow cytometry, is overutilized on AxLNCB specimens identified during breast cancer screening at our enterprise. We aim to reduce routine lymphoma work-up in this population, and, following complete imaging evaluation, will examine specific clinical-radiologic feature(s) to further guide this process change.

1263 Intelligent Use of Immunohistochemistry to Assess Sentinel Lymph Nodes for Occult Melanoma with Increased Efficiency

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Disclosures: Derek Frew: None; Lauren Duckworth: None; John McAfee: None; Anurag Sharma: None; Eleanor Cook: None; Gabriel Oaxaca: None; Steven Billings: None; Shira Ronen: None; Jennifer Ko: None

Background: Sentinel lymph node biopsy (SLNB) is essential in melanoma management; defined standards do not exist for pathologic processing. Our current protocol examines a single H&E stained slide first, followed by three IHC (MelanA, HMB45, and SOX10) ordered in H&E negative cases. This study examines the current protocol to identify strategies to improve quality and efficiency.

Design: Melanoma cases with SLNB performed were retrieved from our anatomic pathology database (2015-2021, 795 cases); 296 consultation cases were excluded.

Results: Patients (299M:200F, median age = 65 years) had: superficial spreading (SS) (52%), nodular (22%), nevoid (4%), acral (4%), lentigo maligna melanoma (LMM) (3%), spitzoid (2%), and desmoplastic (DM) (1%) melanoma, with stages pT1 (37%), pT2 (28%), pT3 (18%), or pT4 (10%), most frequently located on extremities (39%), trunk (26%) and head and neck (23%). Average mitotic rate was 3.8/mm^2. SLN positivity did not correlate with number of nodes excised. Cases with metastatic melanoma contained higher pT stages (p<0.001) and mitotic rates (p<0.001). Histologic type was significantly associated with SLNBx positivity (p<0.001). Lesions occurring on distal extremities (acral anatomic site) had the highest rate of SLNB positivity (61%), but the numbers were too small to statistically analyze. 146/499 (29%) cases were positive, including a total of 194 positive nodes found, of which 75% were occult (145/194; required immunohistochemical staining). SOX10 was the most sensitive marker (135/145; 93.1%) followed by Melan-A (131/145; 90.3%) and HMB45 (126/145; 86.9%). Sensitivity increased with the addition of either HMB45 (143/145; 98.6%) or Melan-A (141/145; 97.2%) to SOX10. HMB-45 was slightly more sensitive in identifying SOX-10 negative cases (8/10 or 80%) compared to Melan-A (6/10 or 60%). On average, SOX10-negative nodes contained smaller metastases (mean 0.05 mm) versus SOX10-positive lymph nodes (mean 1.76 mm) (p=0.009).

Conclusions: Given that tumor was occult in 75% of positive SLNB, IHC staining up front, with initial H&E sections, could significantly improve turn-around time. SOX10 had the highest sensitivity (93.1%) and should be performed initially. Two unstained slides should be provided at the time of initial sectioning to obtain Melan-A and HMB45 stains when SOX10 is negative. This proposed workflow would safely decrease time and cost, and increase efficiency.

1264 Standardized Assessment of Ki-67 Staining Detects Variability Between IHC Assays

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Disclosures: Regan Fulton: *Stock Ownership*, Array Science, LLC; Anja Roden: None; Andrew Bellizzi: None; Megan Troxell: None; Elizabeth Chlipala: None; Allen Gown: *Speaker*, Agilent Technologies; Yaping Wu: None; Jinru Shia: None; Francesca Ruggiero: None; Jingxin Qiu: None; Hannah Allison: None; Scott Crawford: None; Henrik Høeg: *Employee*, Visiopharm A/S; Mateusz Tylicki: *Employee*, Visiopharm A/S; *Stock Ownership*, Kheiron Medical Technologies; Thomas Ramsing: *Employee*, Visiopharm corp.; Jeppe Thagaard: *Employee*, Visiopharm Corp; Dirk Vossen: *Employee*, Visiopharm, Philips

Background: The proliferation marker, Ki-67, is used for diagnosis and therapeutic decision-making in a variety of clinical scenarios. However, there is a lack of standardization of all aspects of Ki-67 IHC assays, resulting in striking differences between proliferation indices (PI) reported by separate laboratories.

We examined a newly developed cell culture-based calibration standard, in combination with an Artificial Intelligence-based Image Analysis (IA) application, to determine whether we could detect differences in PI from IHC assays run in 9 separate laboratories.

Design: A calibration control, consisting of stepwise mixtures of two cell types, *Spodoptera frugiperda* (Sf9), a line that is non-reactive for Ki-67, and Karpas, which is approximately 80% positive. The mixtures were formalin-fixed, and paraffin embedded and used to create a cell culture microarray, consisting of 3 replicates of each of 6 dilutions. The block was sectioned centrally onto 5 different adhesive slide brands and then distributed to 9 laboratories. IHC assays were performed, and the slides were scanned on a NanoZoomer S60 scanner. Images were then analyzed through the Visiopharm Qualitopix platform. In brief, the IA application consists of multiple deep learning models. First, we mapped the image into distinct regions of expected dilution rates. Second, we segmented the nuclei and classified them into positive and negative classes based on the DAB intensity inside the nucleus. Finally, this allowed us to calculate the PI for each individual cell line core in the microarray.

Results: We were able to create a single IA application that generalized between glass slide brands, replicate cores, assays and laboratories. We found no significant variation between slide brands and replicate cores. Our system was able to detect a significant shift in PI between individual laboratories - also within the same clone, see Figure 1. We also found a difference between the clones, where 30-9 have a higher PI score than MIB-1, see Figure 2.

Figure 1 - 1264

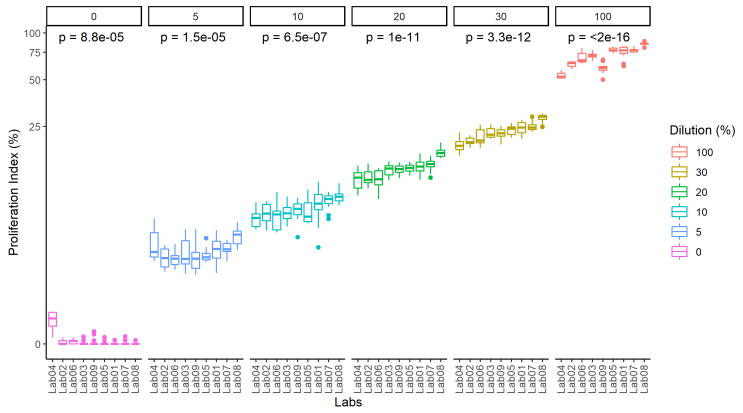
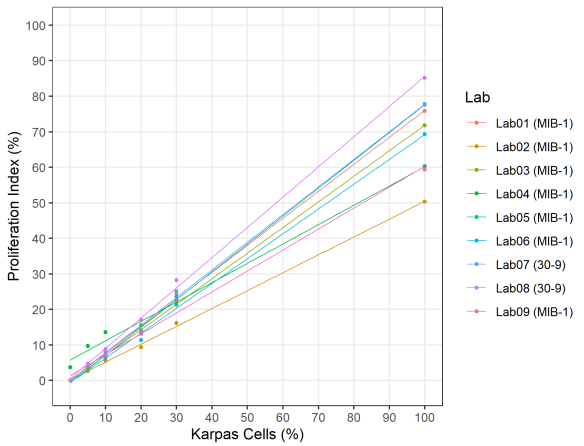


Figure 2 - 1264



Conclusions: In this pilot study, we combined a novel Ki-67 calibration microarray with image analysis and detected reproducible differences in PI among 9 different laboratories. The use of IA removes the manual interpretation contribution to variability and allows examination of the analytic component of the assays. While these results are based on a small sample, they support the conclusion that Ki-67 assays are not highly reproducible and should be optimized to a known standard.

1265 Rates and Causes of Frozen Section Discordance in an Analysis of 352 Whipple Specimens-Focused on Quality Assessment and Improvement

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Disclosures: Julia Gallardo: None; Ramya Masand: None; Shilpa Jain: None

Background: Evaluation of intraoperative frozen section (FS) during pancreatic resections for the status of margins is crucial to drive clinical decision. This study was performed to assess the incidence and causes of discrepancies between FS and permanent sections (PS) of surgical margins in Whipple resections.

Design: Whipple specimens were retrospectively reviewed over 5-year period. Parameters recorded were patient demographics, number of FS requested, margin status, and final diagnosis. Statistical analysis was performed.

Results: 352 Whipple procedures were performed. FS consultation was requested in 336 cases, with a total of 951 FS performed. 49.7% of patients were women, and 50.3% were men. The mean age was 63.79 years (range:21-88). On PS, 158 resections were pancreatic ductal adenocarcinomas (PDACs), 9 cholangiocarcinomas, 55 ampullary adenocarcinomas, 22 pancreatic neuroendocrine tumors, 34 IPMNs, 6 metastases, and 68 benign conditions. The most common indication for FS was margin assessment, which included 446 pancreatic neck, 350 common bile duct margin specimens, and 59 specimens for metastatic evaluation. Uncinate, gastric or duodenal margins were not analyzed intraoperatively. 14 discrepancies were identified: 8 (2.27%) false positive (FP), and 6 (1.7%) false negative (FN) cases. 2 of the discrepant cases (0.6%) were called suspicious/atypical on FS and resulted negative on PS. Intradepartmental consultation was performed only in 4 (28%) of the discordant cases at the time FS. Results showed an 82% sensitivity, 97.3% specificity, 77.78% PPV and 98% NPV, with discordance rate of 3.9%. 83% of discrepancies were found in cases diagnosed as PDACs and 17% in cases of marked chronic pancreatitis. Frequent contributing factors for diagnostic errors were challenging morphology and frozen/cautery artifact, in 75% and 35% of cases respectively; the former was commonly encountered in specimens with chronic pancreatitis.

Conclusions: Our histologic diagnosis was fairly accurate (96%), especially in the setting of a negative test result (NPV 98%), however discrepancy rate is slightly above the reported rate in the literature (average of 3.13%). To reduce diagnostic errors, we recommend cutting deeper sections on FS to reduce cautery artifacts, intradepartmental consultation in challenging cases by subspecialty trained/ experienced pathologist at the time of FS, especially on PDACs. Finally, we encourage frequent monitoring of FS/PS interpretation as part of quality improvement systems.

1266 The Diagnostic Learning Opportunities Conference: Open Discussion of Diagnostic Error Enhances Departmental Safety Culture

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Disclosures: Cynthia Harris: None; Yael K. Heher: None

Background: Medical errors are a source of adverse patient outcomes, have an enormous emotional impact on providers, and contribute to physician burnout. Yet, despite this, errors are little discussed and are often associated with feelings of shame and isolation. To promote our department's goals of teamwork, peer support, and psychological safety, we implemented a quarterly conference entitled "Diagnostic Learning Opportunities" (DLO) in which senior attending pathologists present on a personal diagnostic error, disclosure of the error, and the psychological ramifications of the error on their practice. Documentation of the error is emphasized, whether in the official pathology report, in a safety report, and/or in communication with risk management. The DLO conference additionally offers training in core quality and patient safety concepts, including methods of root cause analysis—such as fishbone diagrams and process mapping—to examine both systems and cognitive biases as sources of error. It utilizes validated tools from the quality and safety literature to teach approaches to quality improvement initiatives.

Design: Prior to the DLO conference, multiple preparatory meetings are held with the discussant to identify an appropriate diagnostic error and focus the narration of events. Based on the nature of the error being discussed, topical quality and safety teaching concepts, such as process mapping, are included in the PowerPoint presentation. The 1-hour conference is held over Zoom. Invited attendees include trainees of all levels, attendings within the subspeciality being discussed, and departmental leadership. Directly following the conference, a short survey is sent to all participants. A final meeting with the discussant is held to debrief on the experience and integrate feedback to improve future conferences.

Results: Thus far, two conferences have been held with a total of 72 people in attendance. Of the 34 survey responses (response rate of 47.2%), 88% agreed that the conferences would help improve our department's "Safety Culture" and 85% reported that the conference enhanced their understanding of root cause analysis and patient safety.

Conclusions: The DLO conference shows promising results in promoting transparency surrounding diagnostic error and fostering a greater sense of community support. Going forward, the conference will be opened to all members of the department, and partnership with treating clinical partners will be explored to increase the impact of the program.

1267 A Systematic, Multidisciplinary Approach to Improving Cytology Laboratory Acquisition of CSF Specimens

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Disclosures: Alec Jacobson: None; Lisa George: None; Cara McLaughlin: None; Kathryn Vargas: None; Laura Stein: None; Laurel Glaser: None

Background: Errors in laboratory medicine, whether pre-analytical, analytical, or post-analytical, may result in significant patient harm. It is particularly critical to limit errors on irretrievable specimens such as cerebrospinal fluid (CSF). At our institution, from November 2019 to November 2020, there were at least sixteen instances (as measured by our event reporting system) of delayed or missing cytology results on CSF specimens. This often leads to repeat lumbar puncture (LP), which increases patient morbidity and hospital spending. We sought to better understand the root causes of this problem and ultimately improve cytology laboratory acquisition of CSF samples through a systematic, multidisciplinary quality improvement effort.

Design: We assembled a multidisciplinary team comprised of pathologists, neurologists, quality improvement experts, lab supervisors, and technical specialists. Our scope included CSF specimens collected by inpatient neurology with the intention of obtaining cytology. Development of multiple quality improvement tools, including process maps, fishbone diagrams, and five whys, led to a thorough understanding of the root causes of the problem, which included: 1) no list of pending CSF orders for cytology; 2) no standardized procedure for ordering, collection, and laboratory receipt of CSF; and 3) more laboratory orders than tubes available for collection. Our pilot interventions target each of these root causes and include: 1) implementation of a cytology pending list; 2) creation of laboratory-focused LP guidelines for neurologists; and 3) utilization of an additional, dedicated sterile tube for cytology during LP. The first intervention was implemented in May 2021, with additional interventions planned for implementation in October 2021.

Results: Since the implementation of the pending list, we have seen no change in testing delays, as measured by the monthly median time from ordering to verification for CSF cytology specimens, but we have actively recovered seventeen samples using the pending list.

Conclusions: We present a systematic, multidisciplinary approach to quality improvement as it pertains to delayed or missing cytology results on CSF specimens. An in-depth analysis of the problem led to targeted countermeasures, one of which has been implemented to date. Next steps for our project include implementation of the two remaining pilots with continued receipt of feedback and data to generate future test cycles.

1268 Comparing Autopsy Thoracic Injury Patterns between In-Hospital CPR Patients Receiving LUCAS Device vs Manual Chest Compressions

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Disclosures: Andrew Jones: None; Jay Hwang: None; Bahadir Yildiz: None; Rohun Bhagat: None; Trisha Arora: None; Wayne Wong: None; Carolyn Jones: None; David Kaufman: None; Caroline Dignan: None

Background: Current research comparing CPR-associated injuries between those receiving LUCAS device and manual CPR has primarily focused on patients who suffered out-of-hospital cardiac arrest. During the SARS-CoV-2 pandemic, more hospitals leveraged mechanical CPR devices to provide distant yet high quality chest compressions for in-hospital cardiac arrest (IHCA) patients. We sought to investigate autopsy thoracic injury patterns in in-hospital non-traumatic cardiac arrests, comparing traditional manual compressions with the mechanical LUCAS device compressions.

Design: Autopsies were screened for a history of in-hospital cardiopulmonary resuscitation in the absence of prior traumatic injuries at a single, large quaternary care center from 1/1/2018 to 06/30/2021. 20 received LUCAS compressions and 40 received manual compressions. Student's T-Tests were used to compare means for continuous variables, while chi-squared and Fischer's exact tests were used for categorical variables. An alpha of 0.05 was chosen as the threshold for statistical significance.

Results: A statistically significant decrease in the rate of sternal fractures and rate of multiple sternal fractures during mechanical CPR was found. A statistically significant increase in other soft tissue injuries, such as pleural wall or lung injuries was seen in mechanical CPR cases, while an increased rate of bilateral rib fractures was noted in manual compression cases. Conversely, no difference in the number or laterality of rib fractures were noted. There was no significant difference in age, biological sex, or rate of scoliosis or kyphosis between cohorts. Results are listed in table 1.

Mode of Compressions	**Mechanical Compressions** (n=20)	**Manual Compressions** (n= 40)	**P value** (* indicates significance)
Mean Age (StdDev)	62.7 (14.4)	66.2 (14.0)	0.38
% Male	75.0%	55.0%	0.13
Rate of Bilateral Rib Fractures	85.0%	92.5%	0.01*
Rib Fracture Severity			
Simple	45.0%	37.5%	P value unable to be reliably calculated due to low sample size per category
Displaced	25.0%	47.5%	
Pleural . . . . . Lacerations	15.0%	12.5%	
Flail Chest	10.0%	0.0%	
Mean Total Rib Fractures (std dev)	7.1 (4.7)	9.1 (3.9)	0.11
Mean Left Rib Fractures (std dev)	3.5 (2.4)	4.5 (1.9)	0.11
Mean Right Rib Fractures (std dev)	3.5 (2.5)	4.7 (2.3)	0.08
Rate of Sternal Fractures	50.0%	85.0%	0.004*

Rate of Multiple Sternal Fractures	15.0%	47.5%	0.01*
Cardiovascular or Great Vessel Injuries	45.0%	22.5%	0.07
Other Soft Tissue Injuries	50.0%	10.0%	<0.001*
Rate of Scoliosis or Kyphosis	20.0%	20.0%	1.00
Severity of Rib Injuries			
Mild Rib Injuries (simple or displaced)	15	35	p = 0.28 Fischer's Exact Test
Severe Rib Injuries (pleural laceration or flail chest)	5	5	

Little research has looked at the injury patterns of mechanical CPR in the IHCA patient population. These results point to a potential difference in thoracic injury patterns from manual compressions when compared to LUCAS device compressions. The statistically significant decrease in sternal fractures with mechanical compressions is noteworthy. Conversely, the increase in other soft tissue injury demands further examination. The decrease in bilateral rib fractures with LUCAS use suggests that placement of the device may play a role in the epidemiology of rib injuries, but not in the number of ribs injured. Further research should examine rib injuries in more detail, and quantify additional comorbidities in both survivors and non-survivors of cardiac arrest.

1269 Appropriate Utilization of Red Blood Cell Units for RBC Exchanges in Sickle Cell Disease Patients: A Quality Improvement Initiative

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Disclosures: Husam Jum'ah: None; Sirisha Kundrapu: None

Background: Automated red blood cell exchange (RCE) remains an effective treatment for acute and chronic management of sickle cell disease (SCD) by preventing acute complications, iron overload, volume overload, increased whole-blood viscosity and by achieving rapid sickle hemoglobin (HbS) reduction. Maintaining a HbS level of < 30% can reduce the complications associated with SCD. Therapeutic apheresis devices utilize either an in-built or web-based formula to determine the RBC units required for RCE based on patient's blood volume, hematocrit, current and the target HbS levels. Sometimes these formulas may result in overestimation of the units needed. The current HbS levels may not be available immediately for all patients. Our objective is to reduce unnecessary use of RBCs for RCE by using a clinically effective simplified formula developed by a research group based on RCE observations over several years, as exchanging with more number of RBC units than needed increases the risk of alloimmunization, transfusion reactions and leads to unnecessary costs for patients and the hospital.

Design: Prior to the intervention, 10 RBC units were used for a one volume RCE at our institution. Each RBC unit for RCE costs around $520. Beginning 2020, the following formula was implemented to calculate the number of RBC units: 10% of body weight in kilograms X HbS level (if unknown assume 100%) as a quality improvement initiative. The average number of RBC units per RCE from January 2020 to June 2021were compared to a 2-year pre-intervention phase from 2018-2019. Further, the associated RBC costs and post-RCE HbS% were also compared.

Results: A total of 14 in the pre-intervention and 18 RCEs in the intervention phase were performed. All 14 procedures in the pre-intervention phase utilized 10 units which resulted in $5200 RBC cost per procedure; post-procedure HbS% was performed on one of 14 patients. The average number of RBCs per RCE during the pre-intervention phase was significantly higher than the intervention phase (10 vs. 7, p<0.0001). During the intervention phase, average RBCs cost for each RCE was $3,600; post-RCE HbS% was evaluated in 9 of the 18 patients which was <30%. None of the patients were admitted with SCD crisis requiring emergent RCE within 6 weeks following the RCE.

Conclusions: Utilizing a simple formula to calculate the RBC units required for RCE procedures has significantly decreased the RBC units used during RCE while reducing the target Hb to <30%.

1270 Clinically Unsuspected Histologic Findings in Submitted Total Joint Arthroplasties: An Institutional Experience in Quality Assurance and Patient Care

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Disclosures: Pooria Khoshnoodi: None; Ivy John: None; Rana Naous: None

Background: The orthopedic literature has mixed opinions on submitting total joint arthroplasty specimens for pathologic examination. Some orthopedic surgeons emphasize cost-effectiveness as the main reason to abandon such practice, whereas pathologists argue the importance of gross and histologic examination of all arthroplasty specimens as a subset of cases may demonstrate clinically unsuspected histologic findings that may affect patient management and outcome. Prompted by this debate, we investigated our arthroplasty specimens submitted for “degenerative joint disease” (DJD) to shed light on clinically unsuspected histologic findings encountered at our institution that may affect quality assurance and patient care.

Design: Institutional pathology database was retrospectively searched for cases with the post-operative clinical diagnosis of “degenerative joint disease” (DJD) from 9/1/2020 to 9/1/2021. Pathologic diagnosis of DJD as well as any clinically unsuspected neoplastic or non-neoplastic histologic findings divergent from degenerative joint disease changes were documented.

Results: Among 4293 total arthroplasties performed for DJD during the time period of one year, 2834 (66%) were evaluated grossly; while 1459 (34%) were submitted for further microscopic examination including 763 (52.3%) total hip, 661 (45.3%) total knee and 35 (2.4%) shoulder arthroplasties. Clinically unsuspected histologic findings were identified in 197 (13.5%) cases and included avascular necrosis (95 cases, 48%), pseudogout (85 cases, 43%), gout (13 cases, 6.5%), chronic lymphocytic leukemia/small lymphocytic lymphoma (2 cases, 1%), subchondral insufficiency fracture (one case, 0.5%), monoclonal plasma cell neoplasm (one case, 0.5%) and tenosynovial giant cell tumor (one case, 0.5%).

Conclusions: This study demonstrates that a significant number (13.5%) of total joint arthroplasties submitted for DJD at our institution for microscopic examination harbor clinically unsuspected and significant histologic findings that may affect patient management and outcome, thus emphasizing the importance of their pathologic and microscopic evaluation in maintaining quality assurance and optimal patient care.

1271 Comprehensive Morphologic Quantification of Papillary Thyroid Carcinoma Reveals That The Tall Cell Variant is Underreported in Pathology Reports

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Disclosures: Kritika Krishnamurthy: None; Michiya Nishino: None

Background: Tall cell variant (TCV) of papillary thyroid carcinoma (PTC) is an aggressive variant with worse prognosis, often warranting radioactive iodine therapy. Despite the prognostic significance of TCV, the recognition and reporting of this entity is subject to inter-observer variability. We performed morphologic quantification (MQ) of PTCs to examine whether this variability has led to underreporting of the TCV in surgical pathology reports.

Design: This was a retrospective study of 264 thyroidectomies with a diagnosis of PTC. H&E slides of each tumor were reviewed, and the percentage of the following morphologic subtypes or patterns were quantified in 5% increments: classic, follicular, tall cell, columnar, hobnail, oncocytic, Warthin-like, solid/trabecular, and others). Tumor circumscription, encapsulation, angioinvasion, lymphovascular invasion, extra-thyroidal extension, tumor size, T and N stage, and the reporting of tall cells on the final pathology report were also documented. The current WHO definition for TCV was used: tumor cells with abundant eosinophilic cytoplasm, cell height:width ratio >2, and overt nuclear atypia of PTC, comprising 30% or more of the tumor. Statistical analysis was performed using IBM SPSS28 software.

Results: Tall cells were seen in 109 cases, comprising 19% of the tumor volume on an average. Of these, 26% met WHO criteria for TCV based on MQ, but only 10% cases were classified as TCV on the final pathological report. There was agreement in 39% cases with kappa value of 0.458 ($p<0.001$). Of the 81 cases with less than 30% tall cells on MQ, 5% were reported as TCV and 22% were reported to have focal tall cell features (TCF), while of the 155 cases with no tall cells on MQ, 3% were reported to have

focal TCF while 1 was reported as TCV (kappa=0.321;p<0.001). Presence of tall cells based on the MQ correlated fairly with aggressive features such as infiltrative borders (r 0.331;p<0.001), absence of capsule (r 0.340;p<0.001), extrathyroidal extension (r 0.153;p=0.013) and lymphovascular invasion (r 0.169;p=0.006).

Conclusions: The TCV of PTC is subject to significant underreporting. Implementation of standardized morphological criteria is needed to improve the uniformity of TCV reporting.

1272 Results of PD-L1 ”Fit-For-Purpose” proficiency testing in Nordic Immunohistochemical Quality Control (NordiQC)

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Disclosures: Heidi Kristoffersen: None; Rasmus Røge: None; Søren Nielsen: None

Background: Immunohistochemistry (IHC) for PD-L1 expression is applied in different cancer types to identify patients eligible for treatment with immune checkpoint inhibitors. NordiQC provides “Fit-For-Purpose” proficiency testing for PD-L1 IHC expression based on the "3D-approach" aligning Drug, Disease and Diagnostic assay including specific read-out methods for thresholds and cells to be scored.

Design: NordiQC offers two biannual runs for PD-L1 IHC. One run focusing on PD-L1 expression in non-small cell lung carcinoma (NSCLC) and urothelial carcinoma (UC) evaluated by tumor proportion score (TPS) and combined positive score (CPS) and one run focusing on PD-L1 IHC in triple negative breast cancer (TNBC) and UC evaluated by tumor-infiltrating immune cell (IC) score. In both runs, approved companion diagnostic (CDx) IHC assays are used as reference standard methods to evaluate the IHC test accuracy.

Results: In the run focusing on TPS/CPS, the number of participants has increased from 68 in the first run C1 to 211 in run C9. The pass-rate varied from 50% to 91%, with an average of 80%. In total, 39% of the participants used CDx assays according to vendor recommended protocol settings providing an average pass-rate of 92%. For laboratory developed (LD) assays, used by 47% of the participants, an average pass-rate of 68% was observed. 14% modified the protocol settings for CDx assays, giving an average pass-rate of 89%. Insufficient results were typically caused by too weak or false negative staining reactions.

The number of participants in the IC run has increased from 84 in the first run C6 to 125 in run C9 with an average pass-rate of 66%. An average pass-rate of 89% was observed for participants using the Ventana SP142 CDx assay, compared to 25% for participants using other CDx assays. The use of LD assays decreased from 31% in run C6 to 14% in C9 with an average pass rate of 21%. Insufficient results mainly characterized by either excessive reaction in non-immune cells compromising read-out or false negative reactions.

Conclusions: In both PD-L1 IHC runs, LD assays have provided an inferior performance. In the TPS/CPS run interchangeability of different CDx assays was observed, whereas the SP142 CDx assay outperformed other CDx assays in the IC run. Insufficient results can deprive patients their treatment with immune checkpoint inhibitors.

1273 Failure Rate of Clinical Cancer Next Generation Sequencing in Pathology Specimens

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Disclosures: Katherine Latham: *Stock Ownership*, Cardinal Health, Illumina, Hamamatsu Photonics, Quanterix; Fei Dong: None

Background: Next generation sequencing is becoming standard of care for patients with advanced cancer. However, molecular testing can fail for multiple reasons. We analyzed overall success rate and factors related to failure in a large cohort of clinical cancer sequencing cases.

Design: Results from 545 consecutive clinical panel next generation sequencing specimens were reviewed. Reasons for failure included insufficient tissue (defined as <20% tumor purity on slide review), insufficient DNA (defined as <50 ng DNA yielded from

isolation), failed sequencing (with mean target coverage of <50X), and low tumor purity based on lack of expected somatic mutations during clinical interpretation.

Results: 105 of 545 specimens (19%) failed next generation sequencing. Of the failed specimens, 51% failed at slide review, 30% failed at DNA isolation, 6% failed at sequencing, and 12% failed at clinical interpretation. Failure rates varied by tumor type. Ovarian and brain cancers had rates of 3% and 6% failure, whereas pancreatic and colorectal cancers had rates of 38% and 30% failure. For nonglial solid tumors, failure rates of resection, biopsy, and cytopathology specimens were 11%, 25%, and 64%, respectively. Specimens derived from consult tissue blocks failed at a higher rate at DNA isolation or sequencing (39%, 11%) compared to specimens derived locally (22%, 0%), which may be due to greater variability in tissue fixation and processing at outside institutions.

Conclusions: A large cohort of clinical next generation sequencing specimens show a significant failure rate of 19% with the most common reason for failure being inadequate tumor purity in the diagnostic pathology specimen. Predictors of specimen failure include primary tumor type, specimen type, and specimen origin. These findings demonstrate the analytical limitations of using diagnostic pathology specimens for molecular testing. Laboratories and clinicians should recognize preanalytical limitations to successful molecular testing from clinical cancer tissue specimens.

1274 MyPathologyReport: Improving a Pathology Patient Online Resource Using Google Analytics

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Disclosures: Tanner Mack: None; Bibianna Purgina: None; Jason Wasserman: None

Background: Web analytics use online behavior and visitor data to improve user experience and drive search engine optimization. Resources describing the use of web analytics to improve patient education are limited and the amount and scope of website data tracked and reported by tools such as Google Analytics can be overwhelming to the novice user. For this study we used Google Analytics to describe how patients access and interact with MyPathologyReport.ca (MPR), a novel pathology education resource for patients. Our goal was to use this data to improve website access, design, and user engagement.

Design: A retrospective study was performed from September 2018 to August 2021 on data generated by Google Analytics for MPR. No identifying data or confidential medical information was collected at any time. Multiple time points were analyzed to evaluate trends and to identify the strengths and weaknesses of our website. Data included the number of site visitors, average amount of time a user spent on the site, the number of total page views, and the number of users who exited the site after viewing a single page (bounce rate). Information on user country of origin, browser language settings, and referral source (search engine, online patient portal, and social media) were also collected.

Results: In three years, MPR has been visited 656,006 times by 550,490 unique users. These users viewed 978,290 pages (1.49 pages/session), spent an average of 2:05 minutes on the site, and had an average bounce rate of 82.12%. The top three countries that access our site are the United States (41.7%), Canada (19.1%), and India (9.0%). The most common languages are English (86.17%) and French (4.98%), with all other languages each representing <1% of users. Most users access the site via organic search (79.2%), however, 9% arrived at the site through a referral source such as an online patient portal. Patients who access MPR via referral from a patient portal have a longer average session duration (1:21 vs 0:57 minutes) and visit more pages/session (2.38 vs 1.32) when compared to users who arrive via a search engine.

Conclusions: Users are more engaged with MPR when referred through a patient portal. Using the data gathered from Google Analytics we have implemented strategies to improve website design include adding an automatic language translation tool to diversify user accessibility and a search bar to track content of interest. Our future goal is to increase the number of patient portal referrals by having physicians prescribe MPR to patients at the time of diagnosis.

1275 Lymph Node Density (LND) is Inversely Associated with Specimen Length in Neoplastic Colorectal Resections

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Disclosures: Elias Makhoul: None; Brent Larson: None; Ryan Casao: None; Danielle Hutchings: None; Bonnie Balzer: *Consultant*, Core Diagnostics, Castle Biosciences, PathologyWatch; Kevin Waters: None

Background: In a prior study, automated compressive filtration (ACF) was used to entirely submit pericolonic fat to assess lymph node (LN) recovery in 100 neoplastic colon resections. This dataset was used to examine variation in LND and its relationship with sex, age, body mass index (BMI), specimen length, and neoadjuvant therapy.

Design: After initial LN dissection, ACF was used to attempt total LN recovery in 100 colorectal resections (33 right, 52 left, 6 transverse, and 9 total colectomies). ACF was performed with a Parker Isaac Adipress (Ithaca, NY). LND was defined as lymph nodes per 10 cm of colon resected. T tests were used to compare mean LND across groups.

Results: Median LN recovery was 30 (range 4-112) and the median LND was 13.3 (range 1.8-51.6). Mean LND was similar in men (15.0; n=53) and women (16.6; n=47; p=0.42). Mean LND was not significantly different in patients <65 years old (16.7; n=49) and those ≥65 (14.9; n=51; p=0.36). Patients with BMI ≥25 had higher mean LND (17.1; n=54) than those <25 (14.2; n=46; p=0.14), though this did not reach statistical significance. Mean LND was similar in left (17.1) and right colectomies (16.4; p=0.73), but was significantly less in transverse colectomies (7.8; p=0.027 versus combined left and right). Longer right colectomies (≥25 cm) had higher mean total LN counts (41.6; n=18) than those <25 cm (30.3; n=15; p=0.056). However, right colectomies ≥25 cm had lower mean LND (11.9) than those <25 cm (21.7; p=0.0038). Left colectomies >20 cm had only slightly higher mean total LN counts (32.6; n=26) than those ≤20 cm (30.2; n=26; p=0.51). Left colectomies >20 cm had lower mean LND (12.2) than those ≤20 cm (22.1; p<0.001). Left colectomies with prior neoadjuvant therapy (n=18) had lower mean total LN recovered (30.6 versus 31.8; p=0.75) and mean LND (14.9 versus 18.3; p=0.23) than those without (n=34), but neither reached statistical significance.

Conclusions: This study suggests that while longer resections may lead to more total LN, there are diminishing returns as LND is lower in longer resections from both the right and left. This data, along with the low LND in the few transverse colectomies, suggest that LND is greater in the proximal and distal ends of the colon. The lack of significant differences in total LN and LND between treated and untreated LN did not confirm our preconception that fewer nodes were present in treated resection, but rather suggested that retrieval in these specimens is due to difficulty in detection during dissection.

1276 Causes and Trends of Intraoperative Frozen Section Discordance in a Single Training Institution

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Disclosures: Kevin Mijares: None; Miao Cui: None; Ippolito Modica: None

Background: Intraoperative frozen section allows rapid histologic diagnosis guiding surgical management. The procedure has limitations, which can result in final diagnosis discrepancies. Monitoring of discordance rates, along with root cause analysis, is an integral part of laboratory quality assurance. This ensures accuracy of results and identifies key points for improvement, especially in a training hospital where processing is performed by trainees. Our goal is to determine the deferral and discordance rates and to identify and classify the common causes of discordance.

Design: This is a retrospective review of intraoperative consults over a 12-month period. Cases were classified based on requesting service and indication for frozen. Frozen section and final pathology reports were compared to identify deferrals and discordances. Discordant cases were reviewed then classified as either sampling or interpretation error.

Results: There were 2,144 frozen section specimens. Most specimens were from Head and Neck (H&N) (60.4%), Breast (13.6%), and Gynecology (GYN) (10.5%). 1,014 (47.3%) were for evaluation of margins or local invasion, 599 (27.9%) for establishment of diagnosis, 382 (17.8%) for identification of lymph node metastasis, 140 (6.5%) for tissue identification, and 9 (0.4%) for evaluation of inflammation. There were 94 (4.4%) deferrals and 63 (2.9%) discordances. Discordances were due to sampling error in 55 (87.3%) and interpretation error in 8 (12.7%). Of the sampling errors, 20 (36.4%) were for evaluation of

margins, 20 (36.4%) for establishment of diagnosis, 14 (25%) for node metastasis, and 1 (1.8%) for tissue identification. The mean and median monthly sampling error rates are 2.6% and 2.4%, respectively. The highest error rate was in August (7.6%). All interpretation errors are H&N cases consisting of 3 false negative and 2 false positive margins, 2 false negatives for diagnosis of a neoplasm, and 1 false positive for lymph node metastasis.

Service	N (%)
Head and Neck	1294 (60.4%)
Breast	292 (13.6%)
Gynecology	225 (10.5%)
Urology	150 (7%)
General Surgery	81 (3.8%)
Neurosurgery	52 (2.4%)
Thoracic	41 (1.9%)
Orthopedics	9 (0.4%)

Figure 1 - 1276

Sampling Errors by Indications and Service

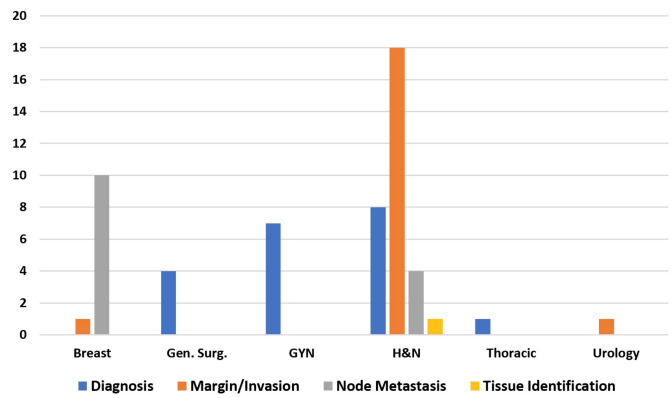
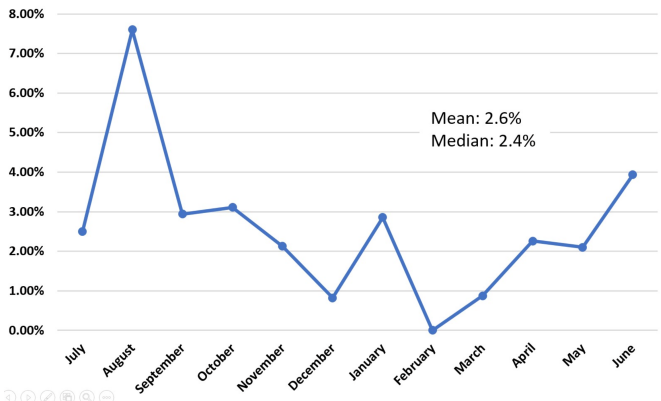


Figure 2 - 1276

Sampling Error Rate



Conclusions: Causes of discordance vary among requesting services. Classification of discordances as either sampling or interpretation error simplifies root cause analysis. Identifying causes of errors provides valuable insight for continuous quality improvement of both the service and training program.

1277 An Analysis of Factors that Affect the DNA Extraction Yield, a Guide to the Molecular Laboratory

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Disclosures: Michael Nakhla: None; Mashiat Mimosa: None; Wafa Al-Ameri: None; Ramzi Fattouh: None; Rola Saleeb: None

Background: DNA extraction from formalin-fixed paraffin embedded (FFPE) tumour tissue is used for downstream molecular tests as PCR and next generation sequencing and is an essential step of the Molecular Pathology laboratory workflow. The DNA output yield from the extraction process varies considerably between individual specimens and cancer types. While some suggest factors that affect the DNA yield as necrosis and tissue volume input, there are limited studies that have assessed these factors. Hence,

there are no set guidelines available to direct the extraction process. We aim to elucidate the relationship between FFPE tissue characteristics and DNA output, as well as to develop a general guideline on how to optimize DNA extraction.

Design: A cohort of FFPE brain tumour blocks was selected (n=46). DNA extraction was performed on unstained 10um sections. Tumour areas were selected from slides through microdissection. DNA concentration was measured with the Qubit 3.0 assay. All corresponding H&E slides were assessed for cell density (number of cells/high power field) (1), % of necrosis (2), and % of hemorrhage (3). Input tumour volume (4) was calculated as tissue surface area and number of sections used for extraction. A formula was used to obtain an estimate of an adjusted cell count (5) incorporating all the factors : volume- (% hemorrhage + % necrosis) x cell density. Univariate and multivariate linear regression analysis of the 5 factors were calculated using the R studio software.

Results: Univariate analysis showed significant association between DNA output concentration and the input tumour volume ($p < 0.0001$) and between the formula of adjusted tumour count ($p=0.0001$). However, on multivariate analysis only adjusted tumour count formula maintained the significant association with DNA output concentration. Individually the factors of necrosis, haemorrhage and cell density did not show significant association with the DNA output.

Table 1. Multivariate and Univariate linear regression analysis of different FFPE tissue factors and their relation to output DNA concentration.

	Multivariate regression	Univariate regression
Section Characteristics	**P Value**	
Adjusted Total Cell Count	0.0449	0.000148
Volume	0.8476	7.48e-06
Cell density	0.2052	0.987021
%Necrosis	0.0737	0.0567
%Hemorrhage/blood	0.6914	0.719

Conclusions: Analysis of FFPE tissue factors showed that only a formula incorporating the multiple parameters of tissue necrosis, hemorrhage, cell density and tissue volume is significantly associated with DNA output yield on multivariate analysis. This formula can be used in clinical practice to guide the targeted tissue areas selected for nucleic acid extraction, and to adjust the number of sections/curls used for extraction on an individual case basis. Using this approach can optimize the DNA extraction step and reduce molecular testing failures in the clinical laboratory.

1278 Intraoperative Diagnosis of Salivary Gland Lesions-When To Use It and Is It Accurate?

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Disclosures: John Pickens: None; Diana Lin: *Consultant*, Proteocyte

Background: Salivary gland tumors can certainly pose diagnostic problems, due in part to their rarity, intra-tumoral heterogeneity, and morphologic overlap. While the Milan System for Reporting Salivary Gland Cytopathology has been extensively studied, to our knowledge, the utility of frozen section for salivary gland lesions has not been described. This study evaluates performance characteristics.

Design: A retrospective search for patients with salivary gland frozen sections in 2020 was performed. Fine-needle aspiration (FNA) and surgical pathology reports were reviewed. A change from benign to malignant or malignant to benign was considered a major discordance.

Results: 41 patients (20 females, 21 males mean age 59 years) were identified, with 38 parotid lesions and 3 submandibular. 24 cases had prior FNA (59%): 2 unsatisfactory, 12 benign (non-neoplastic, benign neoplasm), 9 atypical/indeterminate and 1 malignant. Frozen diagnoses included 31 benign cases, 4 atypical and 6 malignant. On final diagnosis, there were 33 benign

cases, 2 atypical, and 6 malignant. There was substantial agreement (88% concordance, kappa = 0.666) between frozen section and final diagnosis and fair agreement (64% concordance, kappa = 0.290) between FNA and final surgical diagnosis. One major discordance was MALT lymphoma with both benign FNA and frozen diagnoses. Nine patients with benign or malignant epithelial neoplasms on FNA were 100% concordant with final surgical diagnosis.

Conclusions: This study gives insight into not only the diagnostic concordance of salivary gland frozen section but also best utilization. About half of the patients had no prior or non-diagnostic FNA. 38% of patients with prior FNAs had indeterminate diagnoses; meanwhile only 10% of frozen diagnoses were indeterminate. Concordance between frozen section and surgical final diagnosis was higher compared to FNA, likely attributed to the advantages frozens offer, including assessment of lesional architecture and more pathologist control of sampling. 22% of patients had previous FNA diagnoses of benign or malignant epithelial neoplasms that were all concordant with frozen and final surgical resections, indicating frozen section is most likely not warranted in this scenario, particularly is the FNA diagnosis was pleomorphic adenoma. In this study, frozen section best aids intraoperative management when patients opt for surgery without prior FNA or when FNA was non-diagnostic or indeterminate.

1279 Sliding Under The Radar: A Fellow- and Resident-Led Retrospective Quality Assurance Review of Surgical Pathology Reports and Slides

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Disclosures: Aayushma Regmi: None; Jasmine Saleh: None; Ping Tang: None; Maria Picken: None; Grazina Chatt: None; Imran Uraizee: None

Background: Surgical pathology reports (SPR) convey critical diagnostic information and should be accurate and error-free. Retrospective review of SPRs can help identify common errors and areas for improvement. We implemented a trainee-led monthly review of select signed-out SPRs and corresponding archived slides as a quality assurance (QA) measure to identify issues in each SPR component and in slide quality/archival processes.

Design: Over a five-month span, 32 cases per month were randomly selected (approximately 12-16 biopsies and 16-20 non-biopsies) across all surgical pathology (SP) subspecialties at our institution. SPRs were printed and available archived slides pulled for review. Three pathology trainees (one SP fellow and two residents) designed an evaluation form in the Microsoft Teams application (Figures 1 and 2) to document issues warranting amendment consideration, informational errors or omissions, formatting/grammar issues, and spelling errors in final diagnosis (FD), gross description (GD), immunohistochemical (IHC)/special stain reporting, and staging summaries (SS). Availability of archived slides and issues related to slide integrity were noted. Data was collated by SP fellow and presented in aggregate at monthly departmental AP QA meetings.

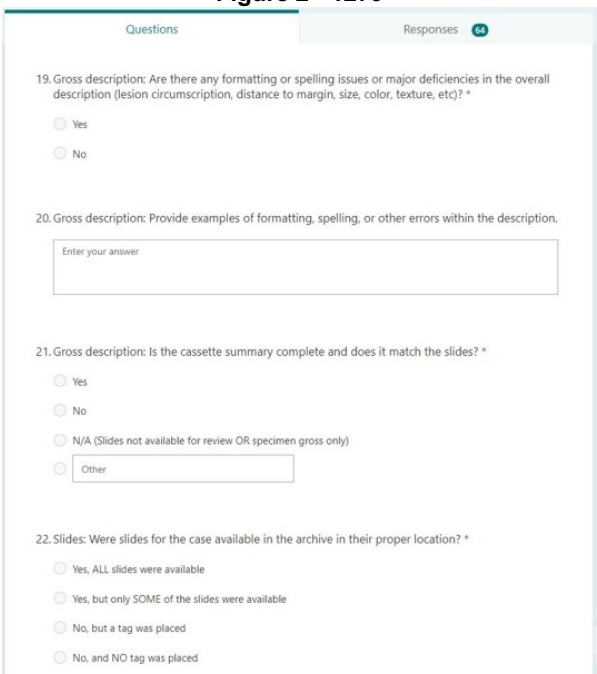
Results: A total of 160 cases were reviewed (70 biopsies and 90 non-biopsies) over five months. Aggregate issues and deficiencies identified in each section of the SPR and slide archive and quality issues are reported in Table, stratified by specimen type. Issues warranting possible amendments, such as lymph node count discrepancies between FD and SS or critical missing parameters in GD, were identified in FD in seven cases, GD in four cases, and SS in two cases. Formatting/grammar errors were most common in FD and GD sections. Six cases in which IHCs were performed had stains omitted or without interpretations. A total of 15 cases had at least one slide missing from archive with no check-out tag, and 63 cases had at least one issue with slide integrity, such as scratches, paraffin debris, and/or label issue.

	Biopsies	Non-Biopsies
Number of Cases Reviewed	70	90
Final Diagnosis (No. cases with Any Issue)	19 (27.1%)	23 (25.6%)
Issue Possibly Warranting Amendment	3 (4.3%)	4 (4.4%)
Informational Error/Omission	3 (4.3%)	5 (5.6%)
Formatting/Grammar	12 (17.1%)	15 (16.7%)
Spelling	2 (2.9%)	5 (5.6%)
Gross Description (No. Cases with Any Issue)	39 (55.7%)	38 (42.2%)
Issue Possibly Warranting Amendment	1 (1.4%)	3 (3.3%)
Informational Error/Omission	2 (2.9%)	10 (11.1%)
Formatting/Grammar	38 (54.3%)	30 (33.3%)
Spelling	0 (0%)	2 (2.2%)

Cassette Summary Discrepancy	1 (1.4%)	2 (2.2%)
IHC/Special Stains Performed (No. Cases)	20	30
Informational Error/Omission	2 (10%)	4 (13.3%)
Staging Summary Performed (No. Cases)	0	35
Issue Possibly Warranting Amendment	N/A	2 (5.7%)
Informational Error/Issue	N/A	5 (14.3%)
Slide Availability in Archive		
All slides available	63 (92.6%)	75 (85.2%)
Some slides available	1 (1.5%)	1 (1.1%)
No slides available, check-out tag placed	1 (1.5%)	4 (4.5%)
No slides available, no check-out tag placed	5 (7.4%)	8 (9.1%)
Slide Quality		
Quality Issue/Deficiency in Any Single Slide	25 (39.1%)	38 (50.0%)

Figure 1 - 1279

Figure 2 - 1279



Conclusions: Retrospective monthly SPR and slide quality reviews are an effective strategy for identifying issues and deficiencies within each SPR component and in histology and slide archiving practices. Aggregate data provides opportunities for evidence-based improvement of SP workflows to ensure high quality SPRs. Inclusion of pathology trainees in the QA process provides a valuable educational opportunity in laboratory management.

1280 Quality Improvement for Reporting of Sputum Gram-stained Smears and Correlation with Culture

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Disclosures: Pranav Renavikar: None; Taylor Wahlig: None; Macy Wood: None; Hannah Creager: None; Paul Fey: *Grant or Research Support*, BioFire, Merck

Background: Gram staining is crucial in the workup of sputum from patients with respiratory tract infections to guide etiology and initial antibiotic therapy. Subsequent sputum cultures are used to confirm the pathogen. However, correlating the two approaches is challenging because of the high incidence of oral flora contamination. We reviewed sputum Gram stains and compared with the

pathogen(s) isolated on cultures to establish concordance between the two results. Our aim was to assess the quality of Gram stain reporting with respect to number and morphology of pathogens as well as potential oral contaminants. The cases that provided equivocal interpretation were selected and studied.

Design: 600 sputum samples reported by multiple lab technologists at the clinical microbiology lab were reviewed for Gram stain and culture results. Culture results that matched the interpretation on Gram-stained smears were classified as concordant. Discrepant cases were studied further to classify the type of discrepancy and the pathogen identified on culture.

Results: 92/600 (15%) cases showed discrepancy between Gram-stained smears and subsequent culture results. Amongst the discrepant cases, 60% were called “mixed Gram positive and Gram negative flora” but showed predominant growth of one or two pathogens in addition to the normal respiratory flora on culture, 20% cases were called “no organisms seen”, whereas 20% cases failed to identify a second pathogen that was isolated on culture. Most culture-identified pathogens amongst discrepant cases included *Staphylococcus aureus* and *Pseudomonas aeruginosa.* Further, 13 cases were flagged in one month of prospective review. Reporting for 4/13 (30%) cases called “no organisms seen” remained unchanged in the second review, whereas 9/13 (70%) cases initially reported as “mixed flora” were reported with additional morphologic descriptors like “Gram positive cocci in pairs”, “Gram negative rods” etc. Final culture results were concordant with the findings on second review.

Conclusions: Limited use of morphologic description for pathogens on Gram-stained smears was the predominant cause of discordance between Gram stain and culture results. Strategies to reduce similar occurrences in the future included flagging and reviewing equivocal cases with the microbiologist before releasing to the clinical team. This approach was discussed with the lab team and implemented as potential improvement in the quality and accuracy of sputum Gram-stain reporting.

1281 Significant Waste Reduction Following Implementation of Peripheral Smear Review Criteria

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Disclosures: Nathalie J. Rodrigues Simoes: None; Andres Mindiola Romero: None; Evan Goyette: None; Kari Agan: None; Leslie Browne: None; Lauren Farnsworth: None; Prabhjot Kaur: None; Eric Loo: None

Background: Peripheral blood smear review volumes were becoming increasingly unmanageable in our laboratory system. A significant number of these cases were externally requested in samples with normal or minimally abnormal hemograms, often resulting in low-value reports that were non-contributory to clinical care decisions. We retrospectively assessed different hemogram parameter combination filters and successfully implemented a set of threshold criteria for pathologist blood smear review, with significant waste reduction as outlined below.

Design: After a literature review, potential hemogram-based gatekeeping criteria were gathered from the International Society for Laboratory Hematology, and World Health Organization. Threshold filter combinations were designed, then retrospectively trialed against all pathologist blood smear reviews aggregated over a two-month period at our institution. External parasite or hemolysis evaluation requests and internal technologist-initiated reviews were exempted. Criteria sets were compared against a number of negative/normal smear interpretations, and whether the review led to a direct alteration in care (e.g. hematology referral, additional workup; derived from chart review). The set which appeared to work best for our institution was adopted, and results/issues were tracked for an additional month in real-time.

Results: 234 blood smear reports were generated in the two pre-implementation months, 200 of which were external clinician orders. The following hemogram criteria set was chosen for implementation: WBC <4.0 or >30.0K/uL; Hgb <7 or >16.0g/dL for both sexes; PLT <100 or >450K/uL; MCV <75 or >105fL; and ANC <1.0 or >20.0K/uL. A peripheral smear would be approved if a request met at least one of these parameters. These criteria would have led to only 110 external smear reviews, and all 90 rejected cases clearly lacked clinical management value. About 12 technologists and 15 pathologist work hours would have been saved. In the month after implementation, 43% of smears were rejected (n=51), seven hematology referrals were placed on cases with rejected smear reviews, zero (0) complaints were filed to the laboratory, and a total of 6.8 technologist hours and 8.5 pathologist hours were saved.

Conclusions: Implementing pathologist smear review by filtering criteria significantly decreased waste in the forms of unnecessary test utilization and technologist and pathologist time, without apparent detriment to patient care.

1282 Performance of EBUS FNA vs Biopsy in Diagnosing Lung and Mediastinal Lesions: A 2-year Retrospective Analysis in an Academic Institution

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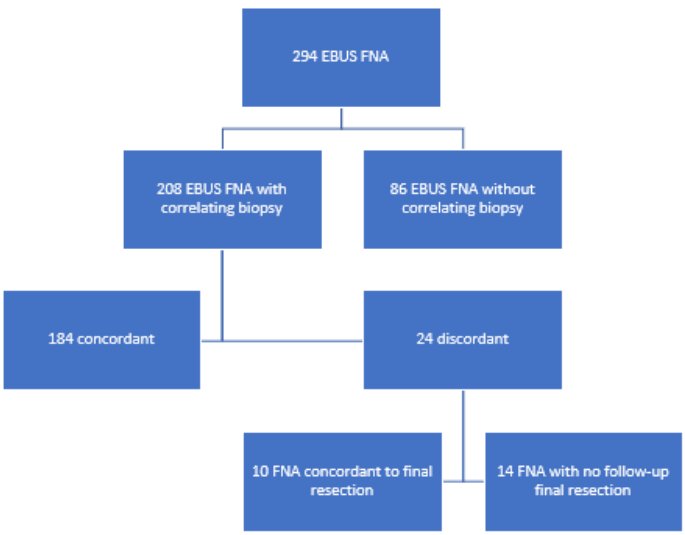
Disclosures: Natali Ronen: None; Diana Owens: None; Tamar Giorgadze: None

Background: Endobronchial ultrasound (EBUS) is a procedure used to visualize the lung airway and to aspirate or biopsy lung lesions, mediastinal/hilar lymph nodes. As part of quality assurance study in our institution, we retrospectively analyzed FNA (fine needle aspiration) and biopsy performance interpretation as well as the use of immunohistochemistry (IHC) stains in each procedure.

Design: A computerized search for EBUS FNA of lung lesions during January 2020- July 2021 was performed. The evaluation included the number of EBUS passes, final concurrent cytology, biopsy and surgical pathology diagnoses, and IHC use.

Results: Out of 294 patients [age range from 25-93 (average 68.1)], 208 had both FNA and biopsy and the remaining 86 had only FNA. Average number of passes was 3.5. Rapid on-site evaluation was performed in every EBUS case. When comparing EBUS FNA to the biopsy, 88.4% (184 of 208) of the cases were concordant and 11.5% (24/208) were discordant. Of the 24 discordant cases, 100% (10/10) of the FNA cases with available follow up were concordant with the final resection specimen while none of the concurrent biopsy specimen were concordant (Table 1). Furthermore, the FNA cases with no correlating biopsy and available follow up resection had 68.7% (11/16) concordant results, and 31.2% (5/16) were discordant. Of the 5 discordant cases, 3 were nondiagnostic and 2 were negative for malignancy. Simultaneous IHC staining in FNA and biopsy specimens was performed in 26.9% (56/208) of cases.

Figure 1 - 1282



Conclusions: EBUS FNA and biopsy evaluation are both excellent techniques for diagnosis of pulmonary and mediastinal lesions. However, EBUS FNA showed superior diagnostic ability to biopsy when compared to the final surgical resection in all cases that had surgical follow-up. The same IHC panel was simultaneously performed in about third of the cases showing similar staining pattern and therefore was not contributing to the diagnosis. Coordinating IHC workup of cytology and histology EBUS specimens may save limited tissue fragments for further ancillary studies and will also avoid unnecessary costs.

1283 Dis-concordance of Radiologic and Pathologic Tumor Size Potentially Leads to Inappropriate Surgical Choice in Stage I and II Renal cell Carcinoma

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Disclosures: Sabika Sadiq: None; Sidrah Khawar: None; Ameer Hamza: None

Background: Radiologic assessment of tumor size is a crucial part of determining the clinical stage for renal cell carcinoma (RCC). Although, the choice of partial versus radical nephrectomy depends on several factors, stage and thus, tumor size is critical, with partial nephrectomy being the preferred modality in stage 1a tumors. The pathologic tumor size is not available until after surgery. Therefore, the decision is based on radiologic tumor size. We assessed the concordance of radiologic and pathologic tumor size in stage I and II RCC to assess the reliability and accuracy of radiologic tumor size as it is applied to clinical stage.

Design: Surgical pathology specimens (partial nephrectomy and radical nephrectomy) received between January 2020 and December 2020 with available CT scan were reviewed. Only pathologic tumor (pT) stage I and II unifocal tumors without neoadjuvant therapy were included in the study. For size, concordance was defined as a size difference within ± 5 mm. Stages were considered concordant if both radiologic and pathologic measurements resulted in same stage category.

Results: Mean patient age was 58.7 ± 11.8 years. Ninety-one (58.7%) patients were male and 64 (41.3%) were female. Specimens included partial (n=129; 83.2%) and radical nephrectomy (n=26; 16.8%). Pearson correlation was 0.94 (P< 0:0001; Fig 1). Size difference was within ± 5 mm in 65.8% cases. Stage classification was concordant in 90.3% cases. Radiologic measurements overestimated stage in 3.9% cases, where pathologically it was 1a and deemed 1b radiologically. It was underestimated in 5.8% cases where pathologically it was 1b and deemed 1a radiologically. The size concordance for stage 1a tumors was higher as compared to other stages (stage 1a 72.5% vs. others 54.4%, p = 0.03; Fig 2). Different histological sub-types (clear cell renal cell carcinoma vs. others), tumor location (polar versus central), and time gap between imaging and surgery (£ 1 month vs. > 1 month) did not affect concordance (Table 1).

Table 1: Concordance by histologic subtype, tumor location and time gap between imaging and surgery.

Clear cell RCC: 68.40%	Other histologic types: 57.90%	P=0.24
Polar tumors: 66.40%	Central tumors: 62.50%	P=0.81
Time gap ≤ 1 month: 64.70	Time gap > 1 month: 66.70%	P=0.87

Figure 1 - 1283

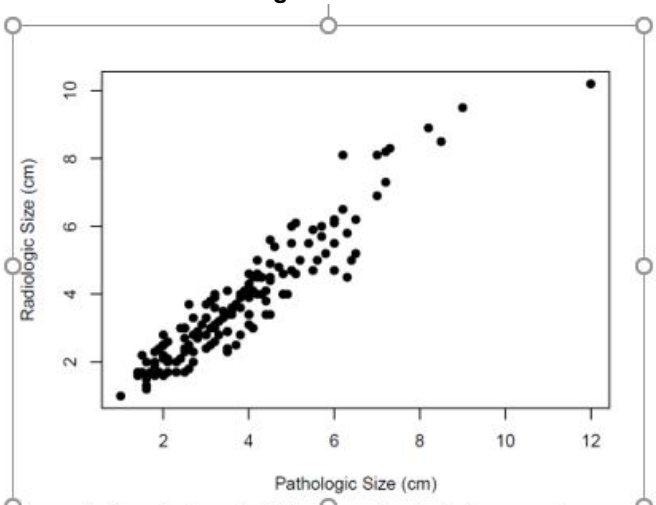

Figure 1: Correlation of radiologic and pathologic tumor size

Figure 2 - 1283

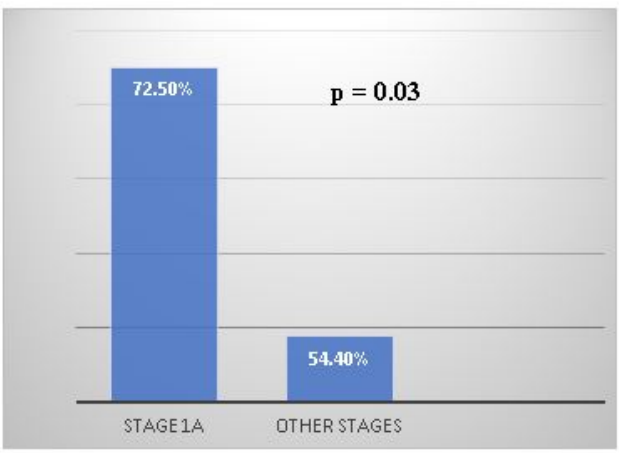

Figure 2: Concordance by tumor stage

Conclusions: Radiologic and pathologic tumor size was concordant in two-thirds of cases. However, the stage was concordant in 90.3% of the cases. Since the tumor size on imaging aids surgical decision of partial versus radial nephrectomy, an improved correlation would denote accurate decision regarding type of surgical intervention for the patient.

1284 Correlation amongst Immunohistochemical (IHC) Scores, Fluorescence In Situ Hybridization (FISH) Groups and Final HER2 Status on Breast carcinoma (BC) and Quality Issues Surrounding Indeterminate FISH Tests: A Single Center Experience

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Disclosures: Alireza Salem: None; Hui Chen: None; Constance Albarracin: None; Yun Wu: None; Nour Sneige: None; Laila Khazai: None; Qingqing Ding: None; Zhenya Tang: None; Aysegul Sahin: None; Esther Yoon: None

Background: The ASCO/CAP 2018 guidelines combine IHC score (0 to 3+) and FISH test (groups 1-5) to determine the final HER2 status (HER2+ or HER2-). In our institution, HER2 by FISH is performed in an equivocal IHC (2+) and/or at the discretion of reviewing pathologist. We describe the correlation amongst IHC scores, FISH groups and HER2 status and discuss issues surrounding indeterminate FISH tests (no analyzable interphases/absence of fluorescent signals).

Design: Consecutive *HER2* FISH tests (dual probe assay; PathVysion) performed in 2019 for primary and metastatic BC were reviewed. The IHC score (antibody 4B5; Ventana), *HER2*/CEP17 ratio, average *HER2* signals/cell, average CEP17 signals/cell, FISH group, and the HER2 status were recorded. IHC scores were categorized into negative (0/1+), equivocal (2+), positive (3+), and borderline (1-2+ or 2-3+). FISH test was categorized to FISH+ (group 1) and FISH- (group 5). Positive and negative agreements between IHC and FISH, final HER2 status for borderline IHC cases were calculated. Preanalytic and postanalytic factors were evaluated in indeterminate FISH test.

Results: FISH tests were performed on 552 cases [222 referral cases (40%), and 330 in-house cases (60%)]. The cohort included 365 primary BC (66%) and 187 metastatic BC (34%). HER2 was positive in 135 cases (24%), negative in 407 cases (74%), and inconclusive in 10 cases (2%). Nine were indeterminate FISH test and one was due to no available IHC. Excluding the inconclusive cases, positive agreement between IHC+ and FISH+ was 95% and negative agreement between IHC- and FISH- was 89%. Seventy-seven percent of equivocal IHC cases were HER2-, and 23% were HER2+. Of 23 IHC borderline cases, 100% of IHC2-3+ cases were HER2+ but also 10% of IHC1-2+ cases were HER2+. Furthermore, 9% of IHC- cases (n=12) were FISH+/HER2+. Refer to table 1 for more detail on IHC and FISH correlation. Indeterminate FISH cases included 2 breast specimens, 3 non-bone specimens and 4 bone specimens (2 referral and 2 in-house). In-house bone specimens had higher FISH success rate compared to referral bone specimens (89% vs 60%) (Figure 1).

Table 1. HER2 Immunohistochemical (IHC) scores and Fluorescence In Situ Hybridization (FISH) groups

Total cases (552, HER2+ = 135; HER2- = 407)	IHC					
	Negative (0/1+) (n =140)	Borderline (1-2+) (n= 20)	Equivocal (2+) (n = 328)	Borderline (2-3+) (n = 3)	Positive (3+) (n = 44)	N/A (n = 17)
FISH Positive Group1 (n = 117)	***12 (9%)****	***1 (5%)***	***58 (18%)***	***3 (100%)***	***40 (91%)***	***3 (18%)***
FISH Group2 (n = 11)	4 (3%)	2 (10%)	5 (2%)	0 (0%)	0 (0%)	0 (0%)
FISH Group3 (n = 23)	3 (2%)	***1 (5%)***	***15 (5%)***	0 (0%)	2 (5%)	2 (12%)
FISH Group4 (n = 77)	17 (12%)	0 (0%)	60 (18%)	0 (0%)	0 (0%)	0 (0%)
FISH Negative Group5 (n = 315)	100 (71%)	16 (80%)	187 (57%)	0 (0%)	2 (5%)	10 (59%)
Indet. FISH (n = 9)	4 (3%)	0 (0%)	3 (1%)	0 (0%)	0 (0%)	2 (12%)

*Represents select group of IHC negative cases that were sent for FISH at the discretion of reviewing pathologist. Indet. Indeterminate FISH analysis; N/A. Not available; Bold and italicized texts indicate final HER2 positive cases. FISH Group 1 = *HER2*/CEP17 ratio ≥2.0; ≥4.0 *HER2* signals/cell; FSH Group 2 = *HER2*/CEP17 ratio ≥2.0; <4.0 *HER2* signals/cell; FISH Group 3 = *HER2*/CEP17 ratio <2.0; ≥6.0 *HER2* signals/cell; FISH Group 4 = *HER2*/CEP17 ratio <2.0; ≥4.0 and <6.0 *HER2* signals/cell; FISH Group 5 = *HER2*/CEP17 ratio <2.0; <4.0 *HER2* signals/cell

Figure 1 - 1284

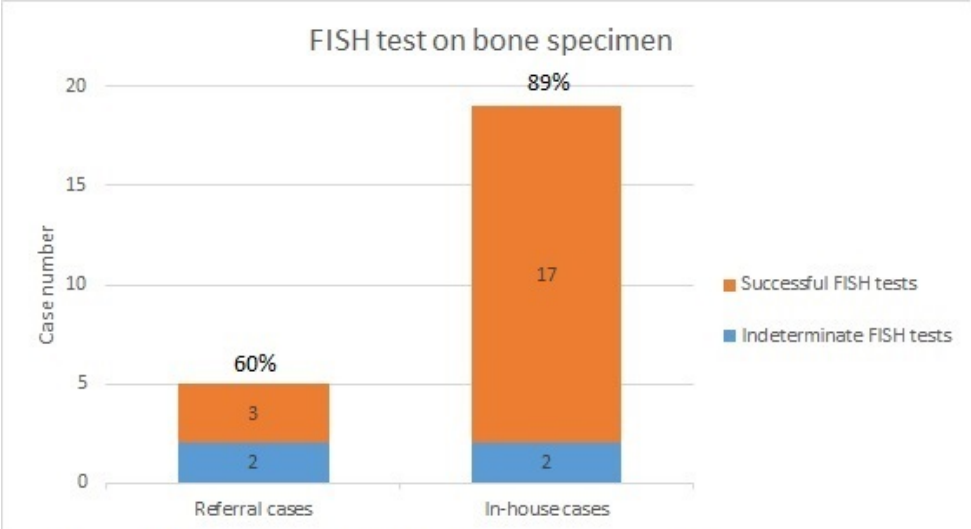

Figure 1. Number of FISH tests on bone specimen

Conclusions: FISH evaluation is essential to HER2+ tumors in IHC negative and borderline IHC1-2+ cases. Overall, indeterminate FISH rate was very low, and slow decalcification process with formic acid in our institution might have contributed to the higher success rate.

1285 Agreement Between Rapid On-Site Evaluation and Final Cytologic Diagnosis: A Single-Institution Experience

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Background: Rapid on-site evaluation (ROSE) increases the diagnostic yield, accuracy and utility of biopsies. ROSE provides an on-site preliminary interpretation so that rapid clinical decisions can be made (e.g., whether additional passes are needed for definitive diagnosis and/or ancillary studies), thereby improving patient care. Many studies have focused on the impact of ROSE on FNA sample adequacy; however, there is little literature regarding concordance between ROSE and final cytologic diagnosis (FCD). This study aims to 1) determine the concordance rate between ROSE and FCD, 2) identify causes of discrepancy, and 3) evaluate how cases with major discrepancy are handled.

Design: We retrospectively reviewed cytology reports of all FNA procedures with ROSE from 01/2020 to 12/2020. Board-certified cytopathologists attended most ROSE cases. The on-site cytologic assessment, FCD, and clinical follow-up data were assessed. Cases were classified as: 1) no discrepancy; 2) minor discrepancy- lacking significant clinical impact; 3) major discrepancy- with likely significant impact on management. Causes of discrepancy were divided into three groups: sampling error, interpretive error, and need for ancillary studies. The handling and communication of cases with major discrepancy by cytopathologists to clinicians was also evaluated.

Results: A total of 1,862 cases were reviewed. 326 cases were classified as discrepant: 318 (17%) minor and 8 (0.4%) major, (82.5% concordance). The most frequent cause of discrepancy was sampling error (n=207, 11.1%). Discrepancies due to requirement of ancillary studies represented 4% of cases (n=74). Interpretation errors were the least common (n=45, 2.4%). The major discordant cases were due to over-interpretation of reactive cells as malignant (e.g., reactive histiocytes in silicosis and atypical squamous cells in aspergillosis). Three cases with major discrepancy were due to “adequate” ROSE in thyroid FNAs that were non-diagnostic on FCD. Communication with clinicians was documented in half of the major discrepancy cases (n=4).

Table 2. Characteristics of all studied cases with minor and major discrepancies.

	Major (n=8)	Minor (n=318)
Procedure location:		
Main Hospital	3 (37.5%)	298 (94%)
Regional Hospitals	5 (2.5%)	20 (6%)
Tissue source:		
Lung	1 (12.5%)	119 (37.5%)
Lymph node	1 (12.5%)	135 (43%)
Pancreas	2 (25%)	26 (8%)
Thyroid	3 (37.5%)	8 (2.5%)
Parotid	1 (12.5%)	6 (1.8%)
Subcutaneous	0	4 (1.2%)
Miscellaneous	0	20 (6%)
Procedure type:		
EBUS	2 (25%)	198 (62%)
EUS	2 (25%)	36 (11%)
IR	4 (50%)	63 (20%)
PFNA	0	21 (7%)
Number of Passes:		
1	0	25 (8%)
2-3	7 (87.5%)	155 (49%)
>3	1 (12.5%)	138 (43%)
Cause of Discrepancy:		
Sampling error	0	207 (65%)
Need for Ancillary Studies	0	74 (23%)
Interpretation error	8 (100%)	37 (12%)
ROSE performed by:		
Cytotechnologist	3 (37.5%)	2 (0.6%)
Pathologist	5 (62.5%)	316 (99.4%)
Communicated with clinician:		
Yes	4 (50%)	NA
No	4 (50%)	NA

EBUS: Endobronchial ultrasound. EUS: Endoscopic ultrasound. IR: Interventional radiology. PFNA: Peripheral fine needle aspiration

Conclusions: ROSE has a high concordance with FCD. Major diagnostic discrepancies were very uncommon. Although it's the FCD that determines next steps in patient treatment, ROSE is reliable in facilitating decision making at the time of the procedure. Communication with clinicians and documentation practices in cases of major discrepancy is an area for targeted improvement.

1286 Pathology Review and Cost Benefit Analysis of Ileostomy/Colostomy Specimens: A 20-year Experience.

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Disclosures: Kapitolina Semenova: None; Whayoung Lee: None; Sameer Shah: None; Xiaodong Li: None; Vishal Chandan: None

Background: Ileostomy/colostomy is a common surgical pathology specimen. However, there is no standardized protocol for gross evaluation and sectioning for microscopic review. The purpose of the study was to review the pathologic findings and analyze the cost effectiveness for these specimens.

Design: The pathology database was searched from 2000 to 2020 for Ileostomy/colostomy specimens. Preexisting conditions, gross findings, number of sections and final diagnoses were reviewed and analyzed. The cost of complete pathological examination was calculated at $13 per block (average 15 minutes for grossing, 30 minutes for technician time, and cost of reagents). The hourly pay for pathologists' salary was estimated at $107/hr. Average time for reviewing and signing out each case was 5 minutes. The overall cost of processing and examining these ileostomy/colostomy specimens during the 20-year period was approximated at US $130,000.

Results: A total of 2762 cases were reviewed (1944 ileostomy and 818 colostomy). The most common indication for both was malignancy (42.8% and 36.5%, respectively), followed by inflammatory bowel disease, diverticular disease, trauma and other miscellaneous conditions. Median number of blocks submitted were 2.9 per ileostomy and 2.6 per colostomy case. All 2762 cases (100%) had sections taken for histological examination. A total of 2720 (98.5%) cases did not show any significant pathological abnormality. If non-neoplastic findings (such as pulse granulomas (13), inflammatory/hyperplastic polyps (6), mesonephric adenoma (1), hemangioma (1), candida (1), and pneumatosis intestinalis (1)) are now factored in, then 2743 of 2762 (99.3%) cases underwent full pathology examination without any impact on the clinical management of the patient. Only 19 (0.7%) cases showed a neoplastic condition, which included colorectal adenocarcinoma (n=9), tubular adenomas (n=4), well differentiated neuroendocrine tumor (WDNET) (n=2), carcinosarcoma (n=1), cervical adenocarcinoma (n=1), high grade serous carcinoma (n=1) and CLL/SLL in lymph node (n=1). 18 of these 19 (95%) cases had a known history of malignancy and 7 (37%) of them showed a grossly identifiable abnormality. Only 1 case (a WDNET, from a trauma patient) did not have a prior diagnosis of malignancy.

Conclusions: We do not advocate routine sampling of ileostomy/colostomy specimens. Gross examination should suffice in 99% of the cases. Only selective cases may be sampled, if clinically indicated.

1287 Frozen Section Evaluation of Donor Liver Biopsies: Agreement between Sub-specialized Liver Pathologists and General Surgical Pathologists

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Disclosures: Kusum Sharma: None; Ning Li: None; Rong Hu: None; Jin Xu: None; Xiaofei Zhang: None; Yongjun Liu: None

Background: Interpretation of frozen sections of donor liver biopsies can sometimes be challenging due to various reasons. In most institutions, frozen sections are reviewed by the on-call pathologist who may be a subspecialized liver pathologist or a general surgical pathologist. In this study, we sought to assess the interobserver variation of frozen diagnosis between liver and general surgical pathologists.

Design: We retrospectively retrieved 143 consecutive donor liver biopsies performed from 2018 to 2021 at our institution. The pathology reports were reviewed, and 32 biopsies were selected due to discordance between frozen and permanent sections. These 32 biopsies were retrospectively evaluated by two liver and two general surgical pathologists blindly and independently without knowledge of the original frozen diagnosis or the final diagnosis. The following features were evaluated: small to medium droplet steatosis and macrovesicular steatosis (classified semi-quantitatively into 5% steps), fibrosis on H&E sections (stages 0-4, Brunt scheme), portal inflammatory infiltrate (no, mild, moderate, and severe), and necrosis (absent, present). Interobserver variation was analyzed by pairwise correlation and Cohen's κ.

Results: Steatosis showed a wide range of values from 0% to 90%. In frozen section assessment, the pairwise correlation between liver and general surgical pathologists was high for macrovesicular steatosis (r = 0.86) but moderate for small to medium droplet steatosis (r = 0.44). The correlation between macrovesicular and small to medium droplet steatosis was low in both pathologist groups (r <0.35). Using <5%, 5-33%, 33-66%, and >66% of steatosis as cutoff values to define minimal, mild, moderate, and severe steatosis, the interobserver agreement between the liver and general pathologists was substantial (κ = 0.82) for macrovesicular steatosis but moderate for small to medium droplet steatosis (κ = 0.47). Fibrosis in our dataset ranged from stages 0 to 4, and interobserver agreement was substantial (κ >0.75) for late-stage fibrosis (stages 3-4) but moderate (κ = 0.45-0.55) for mild fibrosis. The agreement was moderate (κ = 0.58) for portal inflammatory infiltrate and substantial (κ = 0.92) for necrosis.

Conclusions: Our results provide helpful information regarding interobserver variation of frozen interpretation of donor livers by liver and general surgical pathologists. Potential features that lead to disagreement among pathologists are identified.

1288 Application of the Newly Published International System for Reporting Serous Fluid Cytopathology in Atypical and Suspicious Diagnosis: A Four-Year Retrospective Analysis

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Disclosures: Yuan Shen: None; Ranjana Nawgiri: None; Palawinnage Muthukumarana: None

Background: Serous fluids are important cytology specimens that provide valuable diagnostic and management information. Lack of a uniform system for serous fluid analysis has limited the quality and consistency in reporting, especially in the indeterminate (ID) categories such as atypia of undetermined significance (AUS) and suspicious for malignancy (SFM). In 2020, the International System for reporting Serous Fluid Cytopathology (TIS) was introduced to reduce reporting variability and provide a standardize communication platform. Studies to validate this system are few; herein we review the role of TIS for AUS and SFM categories in our institution.

Design: A 4-year retrospective search of cytopathology reports for diagnosis of AUS and SFM in pleural, ascitic, pericardial fluids and peritoneal washings were obtained and reclassified using the definitions published by TIS. The ROM was calculated for existing and reclassified diagnoses.

Results: In total, 2627 cases of serous fluids were received at our institution over a 4-year period, with 64 (2.4%) cases of AUS and 14 (0.5%) cases of SFM diagnoses (Table 1). These were reviewed using the published TIS criteria and 11 (13%) ID diagnoses were reclassified into other categories. These included 9 cases of AUS (negative for malignancy – 3, SFM – 6) and 2 cases of SFM (malignant -2). The ROM changed from 50% to 46% for AUS which is at the lower end of TIS (66%+/- 10%) and 86% to 90% for SFM which is slightly higher than ROM established by TIS (82%+/- 4.8%).

Table 1. Application of the International System for Reporting Serous Fluid Cytopathology in Atypical and Suspicious Diagnosis

	Before TIS	After application of TIS criteria	Before TIS	After application of TIS criteria
Variable	**AUS**	**AUS**	**SFM**	**SFM**
Number of patients	61	47	14	18
Total number of serous fluid specimens	64	55	14	18
Pleural	31	28	4	6
Ascites	26	21	8	10
Pericardial	2	2	1	1
Peritoneal wash	4	4	1	1
Total number of cases used to calculate ROM	30	28	7	10
Malignancy confirmed by previous and/subsequent fluid	7	7	1	2
Malignancy confirmed by biopsy	8	6	5	7
No evidence of malignancy	15	15	1	1
ROM %	50%	46%	86%	90%

Conclusions: Our rate of ID diagnoses is low. The ROM for AUS category is difficult to define, however most cases in our institution are “AUS (with a comment favoring reactive)” and anticipated to behave benign; result in lower ROM than that of TIS. All SFM diagnoses were made in cases that are highly suspicious but quantitatively insufficient for a definitive diagnosis of malignancy, hence the ROM rate is high. As in other systems, AUS rate should be a quality indicator for each institution and be monitored rather than a wastebasket category. As the authors of TIS suggest, algorithmic approach to fluid cytology with cell block and immunostains/ ancillary studies is helpful in reclassifying ID diagnoses into definitive categories. TIS is user friendly and appears to be a consistent methodology for standardized reporting. Further studies are needed to evaluate the ROM and define reproducible diagnostic criteria for each category for better utilization of this system.

1289 Evaluation of the Common Practice of Retesting Her2 status in Excision Specimen when Core Biopsy Tested Negative

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Disclosures: Mohan Sopanahalli Narasimhamurthy: None; Paul Zhang: None

Background: About 15% of breast cancers are Her2 enriched. Evaluation of Her2 enrichment is an important determinant for trastuzumab therapy and other neoadjuvant chemotherapy, and detection of Her2 overexpression and/or amplification has been a standard of care in every newly diagnosed invasive breast cancer. When negative in core biopsy (CB), it is a common practice to retest Her2 in excision specimen (ES) in a notion that negative Her2 result in core biopsy could result from tumor heterogeneity. However, the clinical significance and necessity of this practice have not been thoroughly evaluated. We undertook this study to review this common practice for its potential significance and effectiveness.

Design: A QA data of all cases with Her2 tests done from 2009 to 2021 in our institution were retrospectively reviewed and analyzed. Patients had negative Her2 tests (by IHC and/or FISH) in CB and subsequent Her2 tests in ES of the same cancer were included. Her2 was evaluated by IHC first and reflex to FISH when equivocal IHC result was encountered with the current guidelines or criteria set by ASCO and CAP.

Results: A total of 548 cases were found. According to the ES score, 58 cases (58/548, 10.5%) were upgraded to 2+ (n57, 98.3%) or 3+ (n1, 1.7%) on ES. All 58 cases were reflexed to FISH. Among the 58 cases, only 4 cases (including the 3+ case) had Her2/CEP17 ratio >2.0 but Her2/cep17 >6 only in one case (3+ case) and 4-6 in 2 cases and < 4 in one case. With the 2018 updated Her2 FISH criteria, only 3 cases (including the IHC 3+case) were considered amplified. For all 2+ upgraded ES (n57), only 2 (3.5%) and for all cases (n548)3 only 3 (0.55%) were confirmed amplified by FISH. As IHC 3+ was only detected in one case, it seems less sensitive than FISH in detecting Her2 positive cases in this group of cases (Table 1).

Table 1:

Cases	CB IHC	EB IHC	EB FISH
1	1+	2+ 60%	FISH 3.42, 5.89, 1.72
2	1+	2+	FISH 2.57, 2.64, 1.03
3	1+	3+ 10%	FISH 2.77, 7.17, 2.58
			FISH 2.25, 5.34, 2.37
4	2+ <10%	2+	Heterogenous

CB: Core biopsy, ES: Excision specimen, FISH: Fluorescent in situ hybridization

Conclusions: In this cohort, 10.5% of CB Her2 negative cases were upgraded to 2+ or 3+ when IHC was repeated in ES. An overwhelming majority of upgrades were 2+ (98%) and rarely 3+ (1.7%). Among the 2+ IHC upgraded ES cases, only 3.5% were confirmed by FISH to be Her2 positive. The overall discordance of Her2 status between CS and ES is only 0.55%, likely due to tumor heterogeneity. The retest of Her2 status in ES when tested negative in CB did pick up a very rare miss in the CB test. However, the CB test results should be considered very reliable for pre-op patient management purposes. Our study provides data for the analysis of the practicality and cost-effectiveness of this common practice.

1290 Understanding Predictors of Patient Follow-up in Tissue-Poor Endocervical Curettage (ECC) Specimens: A Single Center Experience

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Disclosures: Andrew Spieker: None; Jennifer Gordetsky: None; Leonel Maldonado: None; Mirna Podoll: None; Krutika Patel: None

Background: Endocervical curettage (ECC) specimens routinely aid in diagnosis of cervical dysplasia. At our institution, we routinely use the words “insufficient” or “scant/minute” to convey inadequacy and under-sampling of a ECC specimen. Among patients with an inadequate ECC, conclusions are not possible in absence of a positive concurrent cervical biopsy (CCB). Though a

repeat procedure is recommended for patients with inconclusive results, many are not followed in a timely fashion. The goals of this work are to identify predictors of follow-up within one year among patients with tissue-poor ECC, and to characterize the frequency of non-benign outcomes on repeat procedures among such patients for whom a follow-up procedure was actually performed.

Design: We identified ECC specimens reported as “insufficient” or “scant/minute” in our pathology data system from April to September in 2018 and 2020. Age; HPV status; concurrent cervical biopsy; prior history of ASCUS, LSIL, and HSIL; and pathologic findings on follow-up procedures (if performed) were recorded. We used multivariate logistic regression to identify predictors of follow-up among patients with either no CCB performed or a benign CCB.

Results: We identified 294 patients with inadequate ECC specimens. The mean age was 41.5 years (SD=12.3). A total of 173/294 (59%) patients had a CCB; 64/173 (37%) had LSIL and 27/173 (16%) had HSIL. Among the 83 patients with a benign CCB, 51 (61%) were followed, and 12/51 (24%) had dysplasia/carcinoma reported on their follow up procedure. Among the 121 patients with no CCB, 68 (56%) were followed, and 22/68 (32%) had dysplasia/carcinoma reported on a follow up procedure. We identified HPV18 (aOR=6.3, 95% CI: [1.5, 26.3]; p=0.01), prior HSIL (aOR=3.3, 95% CI: [1.2, 9.4]; p=0.02), and prior ASCUS (aOR=2.1, 95% CI: [1.04, 4.1]; p=0.04) as significant predictors of receiving a follow up procedure on an inadequate ECC. We further found that follow up was markedly lower during the COVID-19 pandemic (aOR=0.24, 95% CI: [0.12, 0.42]; p<0.001). Additional odds ratios are reported in **Table 1**.

Table 1. Adjusted odds ratios (aOR), 95% confidence intervals (CI), and p-values from a Multivariate logistic regression model identifying predictors of follow-up. Included are subjects for whom a repeat-procedure is indicated (that is, subjects with no CCB and subjects with a benign CCB).

Variable	aOR	95% CI	p =
Verbiage: Scant/minute*	1.16	[0.50, 2.72]	0.73
CCB performed	1.71	[0.92, 3.16]	0.09
HPV16	1.54	[0.58, 4.10]	0.39
HPV18	6.28	[1.50, 26.3]	0.01
HPV (Other)	1.38	[0.69, 2.74]	0.36
Prior LSIL	1.27	[0.62, 2.60]	0.52
Prior HSIL	3.32	[1.17, 9.41]	0.02
Prior ASCUS/AGUS	2.07	[1.04, 4.12]	0.04
Age (Years)	1	[0.98, 1.03]	0.92
ECC: Performed in 2020**	0.28	[0.14, 0.53]	< 0.001

* Reference category: “insufficient”

** Reference category: Performed in 2018

Conclusions: The high rate of non-benign results on follow-up sampling to inconclusive prior results is alarming and critically important. This study highlights the need for more effective diagnostic verbiage on inadequate / poorly sampled ECC specimens, to ensure adequate follow-up. This study also supports the hypothesis that the COVID-19 pandemic has had an adverse role in long-term cancer prevention.

1291 Creation of a Pathology Trainee-Led Diversity, Equity, and Inclusion (DEI) Committee: A Long-Term Initiative to Incorporate DEI Training in Pathology

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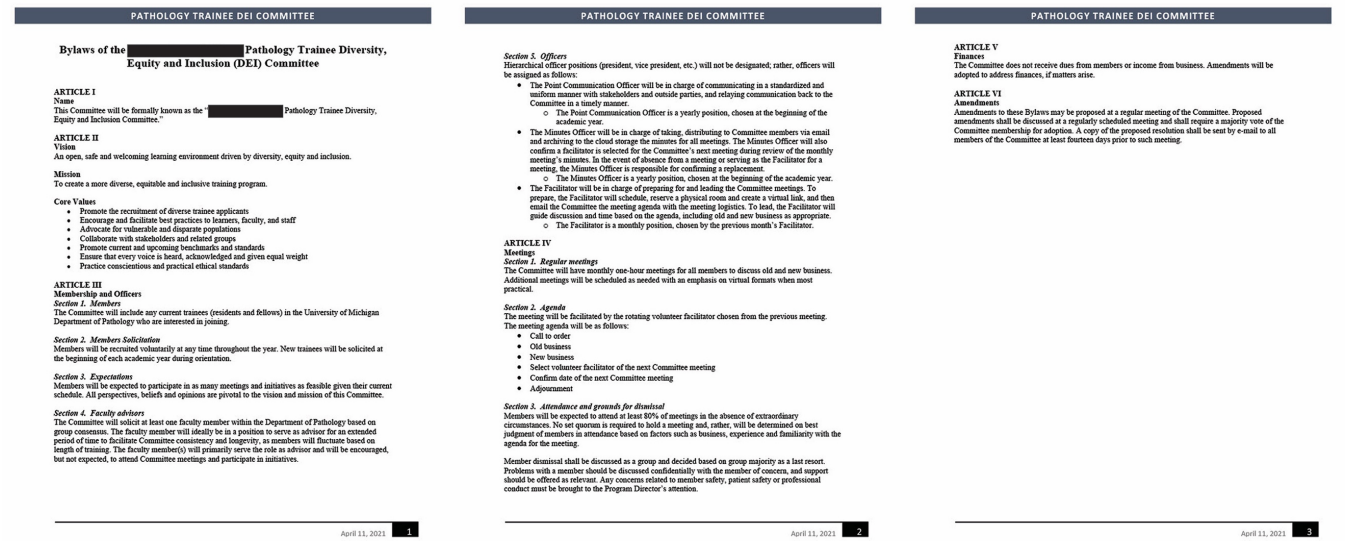
Disclosures: Julianne Szczepanski: None; Jaclyn Plotzke: None; Haley Amoth: None; Batoul Aoun: None; Ashley Brent: None; Elaina Daniels: None; Laurie Griesinger: None; Justin Kelley: None; Lauren Kroll-Wheeler: None; Anna Owczarczyk: None; Alexander Taylor: None; Lauren Smith: None; Cathryn Lapedis: None

Background: Diversity, equity, and inclusion (DEI) have become important topics recognized nationwide as essential components of residency training programs as detailed in the ACGME Common Program Requirements. To directly involve pathology trainees in aspects of DEI, we sought to form a trainee-led committee with a goal to formalize an effective, structured, and self-sustaining organization committed to the improvement of DEI within the program.

Design: Pathology residents and fellows volunteered to be members of the DEI committee. The committee collaborated with program leadership to structure a group capable of completing DEI focused projects, including needs assessments, recruitment tools, and resident DEI education and training tools, among others. This was to be accomplished via adopting monthly meetings with collaborative discussions and creating various responsibilities among members.

Results: After one year of monthly committee meetings, the following tasks were accomplished. In total, 10 trainee members were recruited, including 8 pathology residents and 2 pathology fellows. Leadership positions were assigned, including a Point Communications Officer, a Minutes Officer, and a Facilitator. Two faculty advisors were appointed by the committee members to support and guide our initiatives. A mission statement, core values, and committee bylaws were created and approved by residency program leadership (Figure 1). One major project was completed during this time, which involved creating a needs assessment of DEI within the pathology residency program and analyzing the outcome data in an anonymous manner via a third party. Minor projects were also completed, including creating an infographic representing the program diversity, three resident education presentations involving DEI topics, and organizing a gender identification workshop. After one year, members have a 100% satisfaction of the group's effectiveness as a committee.

Figure 1 - 1291



Conclusions: A committee of this structure allowed residents to lead, participate in, and promote DEI initiatives. Additionally, trainees gained and displayed skills needed to create a successful, collaborative committee. This trainee-led DEI Committee provides an organized and effective framework for accomplishing DEI projects, while sustaining longevity of DEI interest among rotating trainees. Based on our experience, we recommend that pathology programs explore and adopt similar committees to address this essential component of residency training.

1292 Are We Underrecognizing Gleason Pattern 5 on Biopsies? An Institutional Review for Quality Improvement

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Disclosures: Georges Tabet: None; Mohamad Gafeer: None; Aileen Grace Arriola: None

Background: It has been noted that pathologists underrecognize Gleason pattern 5 (GP5) on core biopsies (bx). As GP5 is associated with poor outcomes and may impact patient management, we performed a retrospective review of all radical prostatectomy (RP) cases at our institution with either primary or secondary GP5 and compare to the preoperative bx findings.

Design: We identified RP with GP5 using our pathology LIS. The following data was collected: age, race, lymph node (LN) status, margin status, extraprostatic extension (EPE), seminal vesicle invasion (SVI), RP Gleason score (GS), tumor volume, pathologic stage, type of LN dissection, biochemical recurrence, and bx diagnosis (highest GS [HGS], global GS [GGS], and highest volume

GS [VGS]). Correlation between categorical and continuous values was assessed using chi-square and student T-test, respectively.

Results: 78 RP with GP5 was identified: 3+5 (9%, n=7), 4+5 (78%, n=61), 5+4 (10%, n=8), and 5+5 (3%, n=2). Overall, any GP5 was identified in only 50% (n=39) of corresponding bx. There was no significant difference in GP5 presence on bx when comparing RP GS; however, RP cases with a primary pattern 5 had a higher percentage of GP5 identified on bx as compared to when GP5 was the secondary pattern (70% vs. 47%). Based on bx GGS and VGS, most discordant bx were 4+3 (36%, 14/39 GGS; 30%, 12/39 VGS) and 4+4 (36%, 14/39 GGS; 41%, 16/39 VGS). Based on bx HGS, most discordant bx were 4+4 (56%, 22/39). The largest discrepancy between bx and RP was a bx case with only 3+3. Identical GS on any core bx and final RP GS was only seen in 36% (n=28) and there was no difference between the different RP GS (p-value=0.1144). Among all clinicopathologic features examined between cases where GP5 was or wasn't identified on bx (see Table), only age, LN yield, and type of pelvic LN dissection performed had significant differences. When GP5 was identified on bx, most cases underwent extended-template LN dissection, leading to a higher LN yield, but no difference in pathologic N staging.

Table 1. Clinicopathologic features between cases wherein Gleason pattern 5 was identified vs. not identified on biopsy (RP- radical prostatectomy, EPE- extraprostatic extension, SVI- seminal vesicle invasion, PLND- pelvic lymph node dissection, BCR- biochemical recurrence).

	GP5 Not Identified on Bx N=39 (%)	**GP5 Identified on Bx N=39 (%)**	**p-value**
Age, mean	66 (SD 5)	62 (SD 7)	**0.0029**
Race Black/African American White Other/Unknown	7 (18) 25 (64) 7 (18)	12 (31) 23 (59) 4 (10)	0.3300
RP Margin Status Negative Positive	13 (33) 26 (67)	12 (31) 27 (69)	0.8083
EPE Absent Present	14 (36) 25 (64)	9 (23) 30 (77)	0.2144
SVI Absent Present	22 (56) 17 (44)	21 (54) 18 (46)	0.8199
Tumor volume, mean	37 (SD 19)	46 (SD 22)	0.1250
PLND type Standard Extended	17 (44) 22 (56)	6 (15) 33 (85)	**0.0063**
Total # Positive LN, mean	0.6 (SD 1.3)	1.6 (SD 3.0)	0.0717
Total # LN in PLND, mean	13.8 (SD 8.1)	19.4 (SD 9.3)	**0.0059**
RP GS 3+5 4+5 5+4 5+5	4 (10) 32 (82) 3 (8) 0 (0)	3 (8) 29 (74) 5 (13) 2 (5)	0.4251
Pathologic T stage 2 3 4	11 (28) 27 (69) 1 (3)	6 (15) 31 (80) 2 (5)	0.3535
Pathologic N stage 0 1	27 (69) 12 (31)	20 (51) 19 (49)	0.1053
BCR No Yes Unknown	23 (59) 14 (36) 2 (5)	16 (41) 22 (56) 1 (3)	0.1857

Conclusions: At our institution, GP5 was underrecognized in half of cases in the study. It was recognized more often on bx when GP5 was the primary pattern on RP. This under recognition impacts patient management, with most cases with GP5 on bx undergoing extended-template pelvic LN dissections. Hence, further education of pathologists at our institution is recommended in order to improve recognition and reporting of GP5 on bx.

1293 Prostate Cancer Upgrade and Downgrade Rates from Biopsy to Surgery: A Comparison Between Two Academic Institutions with a Focus on Black or African American Patients

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Disclosures: Georges Tabet: None; Reba Daniel: None; Dina Zenezan: None; Iryna Mazur: None; Priti Lal: None; Aileen Grace Arriola: None

Background: Disparities in prostate cancer (PCa) incidence and mortality in black or African American men (BM) as compared to white men (WM) in the US is well documented and studies involving BM are underrepresented. In this retrospective study, upgrade and downgrade rates of Gleason scores (GS) from biopsy to radical prostatectomy (RP) in two academic settings are examined with a specific focus on rates in the BM in our cohort.

Design: RP cases from preexisting databases of two academic centers (one general [GEN] and one subspecialty signout [SS]) were included in the study. The following data was collected: race, age, lymph node status, RP GS, highest GS on bx (HGSBx), margin status, extra-prostatic or seminal vesicle involvement, pathologic stage, RP tumor volume, and biochemical recurrence. Upgrades and downgrades were defined as any change from HGSBx to RP GS. Association of categorical and continuous values was assessed with chi-square and student T-test, respectively.

Results: 442 cases were identified: 203 (46%) BM, 209 (47%) WM, and 30 (7%) other/unknown. Overall, there were 83 (19%) downgrades and 139 (32%) upgrades. Top downgrades included GS 4+3>3+4 (36%), GS 3+4>3+3 (24%), and GS 4+4>4+3 (16%). Top upgrades included GS 3+3>3+4 (43%) and GS 8>9 (21%). There was a significant association of HGSBx with upgrades/downgrades on RP (p-value=<0.0001), with a high number of changes for HGSBx of 3+3 leading to upgrades and 4+3 leading to downgrades. When analyzing different clinicopathologic features in relation to upgrades/downgrades, only margin status and SVI showed statistically significant differences (p-value=0.0361 and 0.0136, respectively). Downgrades had a higher percentage of negative margins, and SVI in upgrades. A summary of clinicopathologic features for only BM and WM from our cohort are shown in the Table. There were no significant differences in upgrade/downgrade rates between BM vs. WM (p-value=0.1517) and no difference between upgrade/downgrade rates in GEN vs. SS academic practices (p-value=0.1731), but GEN academic practice had a higher RP positive margin status (43% vs 28%, p-value=0.0012).

Table 1. Prostate cancer and various clinicopathologic features in black and African-American vs. white patients from two academic centers.

	Black Men (n=203) (%)	**White Men (n=209) (%)**	**p-value**
Age, mean	59.9 (SD 7.0)	61.9 (SD 7.2)	**0.0048**
Highest GS Bx vs. RP GS Downgrade Upgrade No change	46 (23) 59 (29) 96 (48)	32 (15) 107 (52) 69 (33)	0.1517
RP GS 6 (3+3) 7 (3+4) 7 (4+3) 8 (4+4, 3+5, 5+3) 9 and 10 (4+5, 5+4, 5+5)	51 (25) 96 (47) 25 (12) 8 (4) 23 (12)	43 (21) 79 (38) 24 (11) 17 (8) 46 (22)	**0.0105**
pT Stage 2 3 4	123 (60) 79 (39) 1 (1)	112 (54) 95 (45) 2 (1)	0.3275
pN Stage 0 1	184 (91) 13 (6) 6 (3)	179 (86) 25 (12) 5 (2)	0.1450

x			
Number of positive LN, mean	0.1 (SD 0.5)	0.3 (0.9)	**0.0376**
Margin status Negative Positive	143 (70) 60 (30)	122 (58) 87 (42)	**0.0106**
EPE Absent Present	130 (64) 73 (36)	113 (54) 96 (46)	**0.0396**
SVI Absent Present	174 (86) 29 (14)	178 (85) 31 (15)	0.8750
Tumor volume %, mean	27 (19 SD)	26 (20 SD)	0.6289
Biochemical Recurrence No Yes	119 (64) 66 (36)	136 (69) 60 (31)	0.2937

Conclusions: There is a significant upgrade and downgrade rate of RP GS when compared to HGSBx with changes in nearly half of cases. However, factors like race and type of academic practice did not show any differences with regards to these GS changes. Future studies should examine clinical predictors of pathological upgrading or downgrading.

1294 Trends in Disagreements with Outside Genitourinary Pathology Diagnoses at an Academic Center

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Disclosures: Carley Taylor: None; Kenneth Iczkowski: None

Background: An important function of pathologists at academic cancer centers is the review by the urological pathology expert, of specimens diagnosed at an outside hospital, prior to further treatment. Rates of diagnostic alteration found by others have varied from 9.6% [PMID:27030307] to 37% [PMID:28905666].

Design: Records were kept of total urologic outside consultation cases at our institution, and of cases that had a disagreement from 1 October 2014 to 30 August 2021. Standard practice was to gain assenting opinion of a colleague before disagreeing with an outside opinion. Types of disagreements were categorized.

Results: There were 2749 urologic cases and 560 cases had disagreements (20.4%): total of 751 disagreements (some had >1). By specimen type, prostate biopsies had 566 disagreements among 404 total cases (75.4%); prostatectomy was 35 out of 195 (18%); bladder resection/biopsy was 89 out of 602 (14.7%), and testis was 7 out of 82 (8.5%). In the prostate, undergrading predominated at low and high extremes: missing a secondary Gleason 4 pattern amidst 3, or a 5 amidst 4. In the mid-range, 3+4 was often overgraded as ≥4+3, suggesting that crowded but still separate grade 3 acini were interpreted as a component of 4. Perineural invasion and extraprostatic extension were more often missed than overcalled: 47/566 (8.3%) and 13/566 (2.3%) cases respectively. The most frequent disagreements in prostatectomy specimens was overgrading 3+4 vs. ≥4+3 in 7 out of 45 disagreements (15.6%), overcalling extraprostatic extension (EPE) in 7 out of 45 (15.6%), and margin discrepancy in 7 out of 45 (15.6%).

In bladder biopsy/transurethral specimens, overgrading a low grade tumor as high was 6x more frequent than undergrading, 31 vs. 5/90 cases (34.4%). Overcalling muscularis propria invasion was 6x more frequent than undercalling, in 30 vs. 5/90 cases (33.3%).

In kidney specimens the most frequent disagreement was undergrading tumors in 9 out of 23 cases (39.1%).

Specimen:	Conflict:	Over-call	Under-call
Prostate biopsy	Cancer vs. benign or suspicious	61	85
	Grade 3+3 vs. 3+4	63	87
	Grade ≥4+3 vs. 3+4	77	36
	Presence of Grade 5	14	66
	Perineural invasion	7	47
	Extraprostatic tumor	6	13
	Other n =4		
Prostatectomy	Grade 3+3 vs. 3+4	3	4
	Grade ≥4+3 vs. 3+4	7	1
	Presence of Grade 5	4	5
	Extraprostatic Extension (EPE)	7	6
	Margin discrepancy	0	6
	Other n=2		
Bladder resection or biopsy	Cancer vs. benign	2	0
	Grade low vs. high	31	5
	Muscularis propria invasion	30	5
	Other n = 17		
Cystectomy	n=0		
Renal Pelvis	Grade	3	0
Ureter biopsy	Cancer vs. benign	1	0
	Grade	0	2
Urothelial metastasis	Tumor type n=2		
Kidney	Cancer vs. benign	1	0
	Grade	3	9
	Stage	3	1
	Tumor type n=3		
Penile	Invasive vs. in situ	0	1
	Stage	1	0
Prostate TURP	Grade	1	0
Orchiectomy	Stage	3	2
	Tumor type n=2		
Perineum biopsy	n=1		

Conclusions: It was shown previously that Gleason undergrading by outside non-experts was more frequent than overgrading [PMID: 21738818] but we have now shown that over/undergrading depends on the grade range. Gleason 3+3 versus 3+4 threshold, the most common source of variance, is also crucial to determine whether or not patients are eligible for active surveillance. Certain tendencies were noted in other GU specimens, and more trainee and faculty education plus increasing internal second opinions should help mitigate these difficulties.

1295 Lessons Learned from Gynecologic Cytology Amendment Review: Opportunities in Quality Assurance and Improvement

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Disclosures: Vanda Torous: None; Brenda Sweeney: None

Background: Monitoring quality indicators and analyzing quality data is integral in the cytology laboratory. While there are externally mandated quality measures (such as turnaround time, cytologic-histologic correlation, and retrospective and prospective rescreens), there are several optional quality metrics that may be of additional interest to laboratories. An underutilized resource for quality assurance and improvement is real-time review of amendment reports as it can reveal defects at all stages of specimen handling, monitor both individual and laboratory performance, and highlight vulnerabilities, such as challenging cases that may benefit from secondary review. The goal of this study was to review and characterize amendments issued for gynecologic cytology (GynC) cases as this is a diagnostically challenging area in cytology.

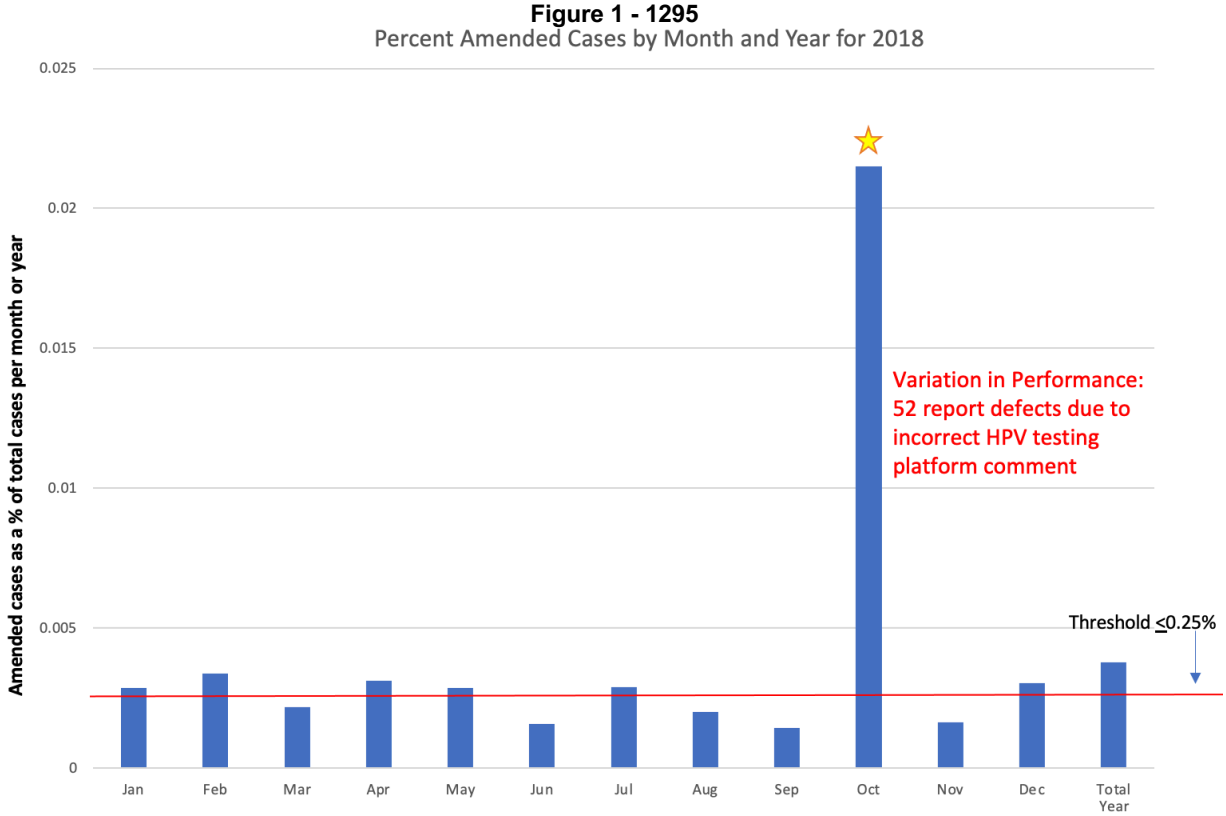
Design: GynC amendment data was reviewed and categorized for a 3.5-year study period (1/2018-6/2021). Amendments are defined as secondary reports issued due to a change of information in the original report. These were divided into three categories:

identification (mislabeling, wrong anatomic site, date of service), report defect (typographical error, screening review comments, addition of quality control review), and diagnostic information (adequacy, HPV test, or diagnostic category change).

Results: There were 213 total GynC amendments accounting for 0.26% of the total GynC cases (80,572) during the study period. This varied per year (0.43% in 2018; 0.20% in 2019; 0.21% in 2020). The majority of amendments were due to report defects (74.2%) with fewer due to diagnostic (15.0%) or identification (10.8%) issues. Data analyzed for 2018 showed an uptick in amendments due to a reporting error when HPV platforms were changed (Figure 1). Causes of diagnostic error are shown in Table 1. Interestingly, about half of the cases with change in diagnostic category (7/15, 47%) involved either the over or under interpretation of glandular cells/lesions.

Diagnostic Error (N=32)	Count	Percentage
Adequacy Statement	**2**	**6.2**
Alteration in High-Risk Human Papillomavirus Virus Results	**15**	**46.9**
Change in Diagnostic Categories	**15**	**46.9**
Non-diagnostic - Negative	2	13.3
Negative - Asc-us	3	20.0
Negative - LSIL	1	6.7
Negative - Negative/Glandular cells	3	20.0
Negative - Atypical Glandular Cells	2	13.3
asc-us - negative	1	6.7
lsil - lsil / asc-h	1	6.7
hsil - Atypical glandular cells	1	6.7
malignant - atypical glandular cells	1	6.7

Figure 1 - 1295



Conclusions: The majority of amendments were due to report defects with fewer due to diagnostic or identification errors. By analyzing amendment data in real-time, process issues can be identified in a timely manner. Diagnostic defects were further examined to identify cases that pose interpretation challenge with glandular lesions overrepresented. Review of amendment data is a helpful way for laboratories to identify process vulnerabilities as well as guide interventions such as secondary reviews.

1296 Supporting a Culture of Patient Safety: Resident-led Patient Safety Event Reviews in a Pathology Residency Training Program

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Disclosures: Catherine Tucker: None; Allison Goldberg: None

Background: Patient safety is a critical component of quality care. In order to support a culture of patient safety, we implemented a patient safety event review process within our pathology residency training program. This resident-centered process utilizes faculty mentors and involves all laboratory staff. The review process includes 1) identification and reporting of patient safety events, 2) event investigation and review, and 3) presentation of findings to the residency program and key personnel for consideration of implementation of an identified objective solution. Here we present a series of five event reviews conducted between January to August of 2021 and their effect on the culture of patient safety in our residency program.

Design: Patient safety events are identified and reported by pathology residency program trainees and laboratory personnel. These events are collected, assessed and selected for review by patient safety mentors and involved residents. Residents systematically investigate events using a standardized workbook. The workbook includes slides which provide tools for brainstorming event causes and solutions.

Final presentations include four specific slides from the standardized workbook: event story board, causal threads, causal statements, and action plan. The solution identified by the resident team is presented and either adjusted, implemented, or re-visited. Resident involvement in patient safety event reporting and patient safety event review outcomes are measured.

Results: Events reviewed since January 2021 include two pilot events performed by the program's current patient safety mentors and three subsequent reviews by pathology training program residents. Table 1 reflects quantitative assessment of participant patient safety event reporting knowledge before the first patient safety event review, and after the most recent event review (Table 1). Chi-squared test is used to compare populations and p-value is set at 0.05.

All event reviews conducted thus far have resulted in implementation of solutions discussed during event review presentations.

Question	Pre-event review affirmative responses (n=16)	After fifth event review affirmative responses (n=17)	P-value
Have you ever witnessed a patient safety event?	5	9	0.09
Do you know how to report a patient safety event?	4	8	0.08
Have you ever reported a patient safety event?	2	5	0.17

Conclusions: Our results thus far indicate a trend towards increased recognition and reporting of patient safety events, which is a first step towards creating and supporting a culture of patient safety within our department. Future study includes evaluating attitudes after a year of patient safety event reviews and assessing efficacy of implemented solutions decided on during event reviews.

1297 Utility of Bronchoalveolar Lavage (BAL) Cytology in SARS-CoV-2 Patients: A Review of Clinical and Cytologic Findings with Cost Analysis

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Disclosures: Gizem Yilmaz: None; Hamza Tariq: None; Ji-Weon Park: None

Background: Bronchoalveolar lavage (BAL) cytology is a commonly used test in hospitalized patients with SARS-CoV-2 and its demand has dramatically increased in large medical centers. Currently, there are no standard guidelines for using BAL cytology in SARS-CoV-2. Findings such as lymphocytosis, giant cells, hyaline membranes, and intranuclear inclusions have been reported in

BALs from patients with SARS-CoV-2 with varying frequencies. The aim of our study is to evaluate the frequency of these reported morphologic findings and to assess the utility and cost-effectiveness of BAL in the management of SARS-CoV-2 patients.

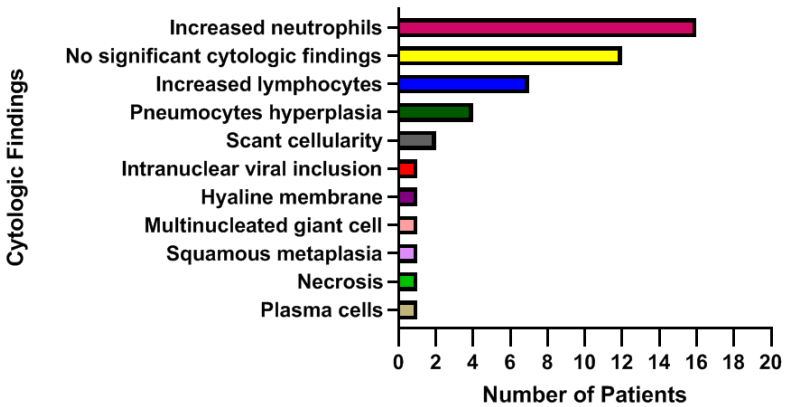
Design: We performed a retrospective review of all BAL specimens from patients with positive SARS-CoV-2 nasopharyngeal PCR at our tertiary care medical center between March 2020 and February 2021. Chart review was performed for clinical findings and microbial culture data. BAL Papanicolaou stained thin prep, as well as special stains (PAS, Fite & GMS) on each case, were reviewed by a board-certified cytopathologist. Billing data was acquired from the laboratory manager.

Results: A total of 37 patients were included ranging in age from 27-84 years (median: 58 years). Their clinical findings are summarized in Table 1. The majority of the BALs showed no specific findings that would help guide or alter the clinical management. 12 cases(33%) showed no significant cytologic findings, 16(43%) showed a relative increase in neutrophils, 7(19%) a relative increase in lymphocytes including one with markedly activated forms, and 4(11%) showed non-specific pneumocyte hyperplasia. PAS+ hyaline membranes, giant cells, intranuclear inclusions, and necrotic debris were each seen in 3% of cases. Special stains were negative for microorganisms in all cases. The cost of BAL thin prep and special stains (professional+techinal components) at our institution was $295 and $265, respectively. The total cost of BAL/patient was $1090 (295+265x3) and the overall cost for 37 patients was $40330.

Table 1 Demographics and baseline characteristics of patients with COVID-19

Age	**27-84 years (median: 58 years)**
Gender	
Males	**24 (65%)**
Females	**13 (35%)**
Ethnicity	
White	**12 (32%)**
African American	**7 (19%)**
Hispanic or Latino	**13 (35%)**
Asian	**2 (5%)**
Other	**3 (8%)**
Dead/Alive	
Dead	**23 (63%)**
Alive	**14 (37%)**
Time between positive COVID testing and BAL	**0-30 days (mean: 5 days)**
Comorbidities	
Hypertension	**10 (27%)**
Obesity	**3 (8%)**
Type 2 Diabetes	**6 (16%)**
Chronic obstructive pulmonary disease (COPD)	**0**
Chronic kidney disease	**9 (24%)**
Solid organ transplant	**3 (8%)**
Immunocompromised state	**14 (38%)**
Coinfection with other respiratory microorganisms	
Bacterial pneumonia	**3 (8%)**
Fungal infection	**2 (5%)**

Figure 1 - 1297



Conclusions: In the majority of the cases, BAL specimens from patients with SARS-CoV-2 showed non-specific findings such as a relative increase in neutrophils and lymphocytes, and pneumocyte hyperplasia. More specific morphologic findings such as intranuclear inclusions, PAS+ hyaline membranes, and activated lymphocytosis are only seen in rare instances. Overall, the use of BAL cytology in SARS-CoV-2 is time-consuming, not cost-effective, and does not help guide or alter patient management significantly.

1298 Analysis of Clinical Impact of Send-Out Molecular Oncology Tests: Comparison Across Tumor Types in a Rural Academic Medical Center

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Disclosures: Ahmed Younes: None; Takeda Kotaro: None; Yaolin Zhou: None

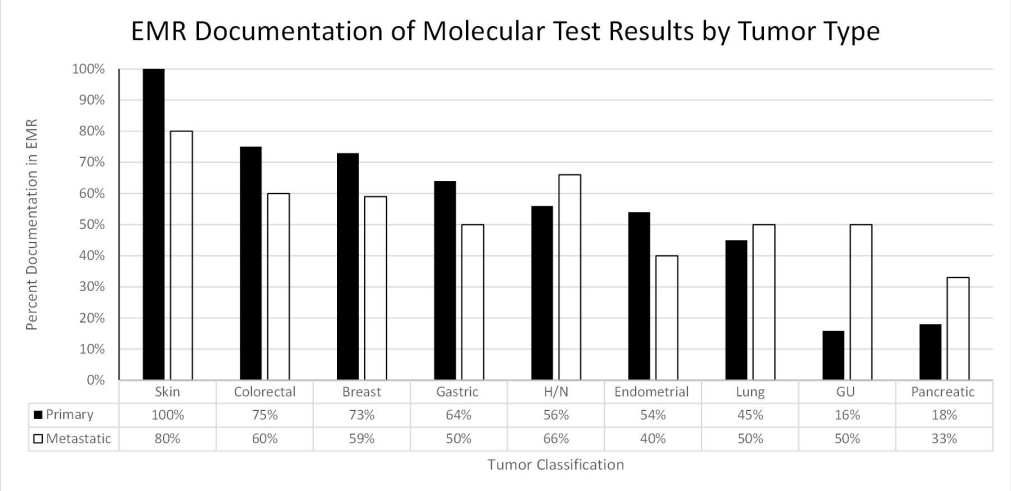
Background: Our academic medical center serves a rural population that does not have access to local molecular oncology testing. In Dec 2020, we developed a molecular pathology consult service to improve the clinical utility of send-out genomic testing and evaluate for documented evidence of clinical impact of molecular test results.

Design: Our quality improvement study was exempt by the local IRB. We retrospectively reviewed clinical charts to assess the impact of molecular tests on 534 unique patients from Dec 2020 – Sept 2021. Actionability of molecular tests (404 results on 278 primary and 126 metastatic tumors) was defined as any documentation in the EMR (e.g., clinic notes, tumor board) regarding results.

Results: Despite the high number of NGS panel orders (260 Caris, 47 Tempus, 44 Foundation, 25 NeoType), molecular results were inconsistently mentioned in the EMR (53.2% of primary and 46.8% of metastatic cancers). Documentation rates were highest among skin (7 of 8, 87.5%), colon (39 of 54, 72.2%), and breast cancers (24 of 36, 66.7%). In contrast, molecular testing for primary genitourinary (3 of 19, 15.9%) and pancreatic cancers (2 out of 11, 18%) were least likely to be referenced. Compared to patients with early-stage cancers, molecular results for advanced-stage patients were less frequently mentioned (29% vs 59%). Interestingly, results for FNAs (30%) and biopsies (32%) were also infrequently documented (vs resections 53%). Treatment was affected in 60% of documented cases, prognostication in 27.5%, and diagnosis in 17%. Molecular tests on breast (100% of 24), melanoma (100% of 7), and lung (96% of 52) cancers showed high rates of treatment impact.

Tumor types	Number of Primary Tumors Tested (% Results Documentation)	Number of Metastatic Tumors Tested (% Results Documentation)
Resulted cases (n= 404)	278 (53.2%)	126 (46.8%)
Lung (n=112)	86 (45.3%)	26 (50%)
Colon (n=54)	44 (75%)	10 (60%)
Breast (n=36)	19 (73.7%)	17 (58.8%)
Genitourinary (n=25)	19 (15.9%)	6 (50%)
Gastric (n=16)	14 (64.2%)	2 (50%)
Endometrial (n=18)	13 (53.9%)	5 (40%)
Pancreas (n=14)	11 (18%)	3 (33%)
Head and neck (n=12)	9 (55.6%)	3 (66%)
Skin (n=8)	3 (100%)	5 (80%)

Figure 1 - 1298



Conclusions: As molecular testing increasingly becomes standard of care, it is reasonable to study the factors that predict the likelihood of actionability from these expensive tests. Four hundred tests at $3,000 each would cost $1.2 million to the healthcare system. However, we observed that not all patients benefited similarly. Later stage cancer patients, GU and pancreatic cancer patients, and patients with limited FNA and biopsy specimens, appeared less impacted by molecular results. Therefore, we recommend developing site-specific test utilization interventions that incorporate reasons behind ordering tests (pre-pre-analytic) and the likelihood of actionability (post-post-analytic) as means to optimize the cost-effectiveness of molecular testing, especially in resource-limited settings.

1299 Consolidating the Electronic Medical Record: A Cytopathology Department Experience

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Disclosures: Hira Yousaf: None; Jana Holler: None; Khalid Amin: None; Jimmie Stewart: None

Background: Consolidation of the electronic medical record (EMR) to a single platform enables more coordinated patient care. Hospital standards recommend a single EMR platform to avoid interface glitches, better workflow and smooth data exchange among hospitals. Recently our hospital underwent a system-wide consolidation of EMR and laboratory information system (LIS). This study was conducted to measure the effects of this switch on quality metrics in our laboratory.

Design: Turn-around times (TATs) is a standard quality assurance measure. Our protocol is to report 90% of the results within 2 business days for all non-gynecologic cytology cases. Average TATs were calculated for the last month of the previous LIS (June), go-live month (July) and one month post go-live (August). TAT was measured using the LIS automated report generation functionality that generates an automated report for the percentage of cases accessioned in the month. Issues encountered with LIS switch, along with remedial measures taken were recorded.

Results: The average percentage of cases meeting TAT decreased for the months of go-live and post go live, with a TAT of 91% and 90% respectively (Table1). TAT for the affiliated hospital sites were particularly impacted. Site1 which is the central lab maintained TATs primarily due to adequate lab staff training, on site IT support and no transportation requirements. Issues that increased TAT were mainly pre-analytical listed below. Analytical issues also occurred related to case status privileges and ability to report to patient's records. These required amendments to get the report across upon audit of cases. Post analytic issues, while present did not contribute to TAT.

- Changing case accessioning workflow caused routing issues. Previously cases accessioned centrally and transported. Ancillary staff at the designated hospital site are responsible now, causing delays due to limited training.
- Changing order requisition terminology led to incomplete orders, delaying sign-out.
- Hospital-wide label printer issues with only a few printers compliant with the new order formatting.

- Lack of work aid to understand the new pending log reports, limiting staff understanding for tracking cases.

	TAT for month of June		TAT for month of July		TAT for month of August	
	Total cases	Average cases meeting TAT	Total cases	Average cases meeting TAT	Total cases	Average cases meeting TAT
Site 1	439	98%	391	99%	394	97%
Site 2	23	83%	29	76%	17	71%
Site 3	61	100%	54	100%	68	96%
Site 4	76	96 %	73	89%	81	95%
Site 5	160	96 %	144	90%	125	90%
Average cases meeting TAT	95%		91%		90%	

Conclusions: EMR upgrade caused initial delays in the TAT mainly due to the pre-analytical variables. Continuous reinforcement of the new changes to the lab and healthcare staff will aid in remediating these delays.