Conclusions: The microscopic features seen in each sheep where those of pulmonary arteriopathy with intimal thickening (cellular). The endothelial proliferation highly express VEGF but are negative for HIF-1 and NFKB.Therefore overexpression HIF-1 and NFKB are not important mechanisms in the marked endothelial proliferation seen in these type of PH.

Quality Assurance

1547 Comparison of Cytotechnologist and Pathologist Interpretation of HER-2/*neu* Expression in Breast Carcinoma

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Background: Accurate assignment of HER2/*neu* status is essential to clinical decision making in the treatment of breast cancer. Immunohistochemistry (IHC) is commonly used assay for evaluation of HER-2/*neu* status. Despite criteria for interpretation of staining results for HER-2/*neu*, the determination of staining intensity and the percentage of complete membrane staining is subjective. At our institution, IHC HER2/*neu* specimens are pre-screened by a cytotechnologist (CT) prior to final determination by a pathologist as a quality assurance procedure. The aim of this project was to evaluate the interobserver reproducibility of HER2/*neu* analysis among CTs and pathologists.

Design: HER2/*neu* was performed on 4234 paraffin-embedded breast tissue specimens using the DAKO HercepTest™ (DakoCytomation, Carpinteria, CA). One of 9 CTs classified each specimen as 0, 1+, 2+, or 3+ for HER-2/*neu* protein expression. One of 7 pathologists provided a final classification for each specimen. FISH analysis using PathVysion™ (Abbott Molecular, Inc., Des Plaines, IL) was performed on specimens classified as 2+. Only specimens having a CT score, a pathologist score, and a FISH result (if applicable) were analyzed in this study.

Results: Complete concordance between CT and pathologist results was established in 3532 (83%) of all cases. The majority of discordant cases were 1+ and 2+ cases. There were 1041 of 4234 (25%) specimens with a pathologist score of 2+ by IHC that were triaged for FISH analysis. The range of cases scored as 2+ between individual pathologists was 15-33% (mean 25%). Of these 1040 cases, 14% demonstrated HER-2/*neu* amplification (range 11-22%). The range of cases scored by CTs as 2+ was 23-39% (mean 31%). There were 171 discordant cases classified as 2+ by the pathologist; 60 cases were scored as 3+ by the CT (31/60 or 52% FISH amplified) and 111 cases were scored as 1+ by the CT (5/111 or 5% FISH amplified). One case was scored as 3+ by the CT and downgraded to 1+ by the pathologist.

Conclusions: This study demonstrates high interobserver reproducibility between CT and pathologist in the evaluation of IHC HER-2/*neu* results. CTs classified a higher percentage of 2+ cases. Additionally, over half of the cases downgraded by pathologists from 3+ to 2+ were FISH amplified and only 5% of those upgraded from 1+ to 2+ were FISH amplified, indicating that CTs are scoring specimens with acceptable accuracy. In summary, the data indicate that CTs provide reproducible and highly concordant results as the primary evaluators of IHC HER-2/*neu* specimens.

1548 Defining Specimen Mis-Identification by Molecular DNA Analysis

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Background: Assuring accurate patient and specimen identification is a national patient safety goal and the initial step in a laboratory test quality. Mis-identified cases in anatomic pathology (AP) are usually not actively sought by the laboratory, but rather, passively acquired when the clinician receives a nonsensical result. In AP, this frequency is thought to be in the order of 1 per 5,000 cases. However, the actual rate of mis-identification is unknown. We attempted to define that number by focusing on the larger testing volumes of the clinical laboratory where discrepant mean corpuscular hemoglobin volume (MCV) from samples on same patients are compared electronically (delta check) to flag potentially mis-identified blood specimens.

Design: We selected blood specimens that were flagged over 6 days by MCV delta checks at Henry Ford Hospital. Specimens differed by + 3 femtoliters in MCV from one also analyzed on the same patient and were evaluated by ABI Identifiler DNA kit to determine genetic identity.

Results: Of 4269 blood specimens tested on core lab hematology analyzers, 6 were delta flagged and rejected on lab review as mis-identified. An additional 151 (3.5%) were found questionable because of MCV delta check differences. Paired samples for the same individual were recovered for 92 of these from inpatient and emergency room patients (18 pre and 74 post). By molecular genotyping, 89 of 92 (97%) specimens had an identical genotype, confirming that the differences in MCV were likely due to therapy, blood transfusion, or other disease related reasons. Three samples (3.3%) had different genotypes, indicating they were from different individuals, and were mislabeled at phlebotomy. Thus, roughly 1 of 1000 cases submitted for complete blood count testing was mis-identified.

Conclusions: Evaluating blood specimens by DNA analysis provides a larger, more readily obtainable denominator to generate an estimate of actual specimen mis-identification that the laboratory inherits from the pre-analytical phase of clinical specimen collection and labeling. We find this mis-identification rate is 5 times greater than the previous estimate of AP and Blood Bank specimens thought to be mis-identified by virtue of non-sensical result (wrong tissue, blood type) or wrong patient (not biopsied). This study underscores the importance of investing in quality assurance efforts that include pre-analytic process standardization and integration of new technologies to assure maintenance of patient and specimen identity in laboratory testing.

1549 Critical Values in Pediatric Surgical Pathology: Policy Development, Process Implementation, and Reporting in a Children's Hospital

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Background: "Critical values" (CV) reporting is a standard practice in laboratory medicine. Recently the scope of CVs has been expanded to surgical and anatomic pathology by accrediting agencies for patient care and safety. The purpose of this project was to improve timeliness and quality of patient care by defining pediatric surgical pathology (PSP) CVs and documenting verbal reports.

Design: Pediatric medical and surgical specialists and pediatric pathologists were surveyed for potential PSP CVs. A CV list and conceptual, current condition, and target condition flow charts were developed. A standard operating procedure (SOP) was developed. Institutional pathologists were trained in the identification, reporting, and documentation of PSP CVs. Retrospective analysis of PSP CV reporting, prior to the SOP, and concurrent analysis following SOP implementation were studied.

Results: Surveys were completed by 26 physicians. A list of PSP CVs was based on survey results, with Medical Executive Committee approval. Retrospective review of selected diagnoses prior to the project revealed that 80% of PSP CV were documented as verbally reported (59% of new tumor diagnoses, 100% of graft versus host disease reports, 100% of major frozen section discrepancies, and 90% of rectal biopsies for suspected Hirschsprung disease). After SOP implementation, 97% of PSP CV were reported and documented. CV cases accounted for 9% of PSP accessions. The distribution of 210 CVs in a 6-month period after the SOP included tumor diagnoses (37%), invasive organisms (10%), possible Hirschsprung disease (10%), crescents in renal biopsies (2%), erythema multiforme/Stevens-Johnson syndrome (1%), a major discrepancy between preoperative and final diagnosis (1%), and other pathologic diagnoses with immediate implications for clinical management (38%). 14% of CVs involved transplant recipients. Positive feedback has been received from physicians and other healthcare professionals.

Conclusions: PSP CV reporting offers the potential for improved patient care through timely communication and provides an opportunity for systemwide use in pediatric care. These results demonstrate the utility of policy development and process implementation with participation by a multidisciplinary team. This study provides the first systematically derived CVs for PSP.

1550 PCR-Based Microsatellite Analysis of Surgical Specimen Identity: Seven Years of Clinical Application

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Background: Despite policies and practices designed to ensure accurate identity of surgical pathology specimens, errors do occur. The fallout of misidentifying a specimen or of contaminating one specimen with tissue from another can be devastating. PCR-based microsatellite analysis for identity testing has been extensively utilized in the field of forensic pathology, but its role as a tool in surgical pathology has not been adequately addressed. The purpose of this study was to analyze the utility of this technique as a quality assurance method based on a 7-year experience at a large referral hospital.

Design: Surgical pathology cases submitted for identity testing were identified through a search of the files of the Molecular Diagnostics Laboratory of The Johns Hopkins Medical Institutions. Clinical, pathological and genetic identity data were obtained from the Surgical Pathology and Molecular Pathology databases.

Results: Forty-one surgical pathology cases submitted for tissue identity testing were identified during a 7-year period. There was a trend toward increasing utilization from 1 case in 1999 to 11 cases from 1/1/2006 to present. 23 (56%) cases were specimens obtained from other hospitals. A variety of organ sites were represented including prostate (n=17), upper GI (n=6), lower GI (n=5), breast (n=2), kidney (n=2), larynx (n=2), and other sites (n=7). 36 (88%) cases were biopsies and 5 (12%) were resections with or without a pre-operative biopsy. Tissue identity analysis was requested to either confirm a match between the specimen and patient (n=19, 46%) or to confirm a match between a tissue fragment and the rest of a specimen (i.e. rule out "floater") (n=22, 54%). Molecular identity testing established non-identity in 16 (39%) cases. In all of these cases (n=16, 100%) documentation of non-identity had a dramatic impact on the diagnosis. For example, in half of the tested prostate biopsies that showed an adenocarcinoma in a core fragment, the involved core was found to be a contamination from another patient.

Conclusions: PCR-based genetic strategies can establish tissue identity in a way that routine microscopy cannot. The ability to do so can uncover subtle errors that may dramatically alter patient management. Utilization of molecular identity testing should be considered when mislabeling of a diagnostic specimen is suspected (e.g. disparity between the clinical picture and pathologic findings) or when the possibility of contamination from another specimen could affect patient prognosis and management.

1551 Defining the Magnitude of Internal Process Defects in Surgical Pathology

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Background: The frequency of process defects encountered in the analytic phase of Surgical Pathology (SP) from point of specimen receipt to final report transmission is not known. The literature based on amended pathology reports does not address these internal defects that may be repaired if detected but are not often recorded. Knowledge of these defects and how they arise in the mostly manual processes of SP is key to planning quality improvements.

Design: To assess types of internal defects, we surveyed professional, technical and secretarial staff in the division of SP at Henry Ford Hospital (annual accession volume 48,000 cases). From the staff poll, we defined the top 10 defects commonly encountered

requiring acceptance of less than standard work, work stoppage to fix an error or to return work to the sender. Based on these data, we developed 100 indicators of specific SP defects that could be potentially encountered. These indicators were listed on 9 posters with main categories and clarifying sub-menus for 59 staff to document defects encountered in real-time of routine practice over 2 weeks.

Results: Data were collected from January 30-February 10, 2006 comprising 1690 accessioned SP cases. 494 of 1690 cases had defects that were encountered internally within the laboratory. The overall defect frequency was 29.2% (3.3 sigma or 32,479 defects per million opportunties). The majority of defects 441/494 (89%) were encountered in the analytic phase - histology slides (151), accessioning (123), gross exam (99), recuts (66), immuno or special stains (2). 41 (8.3%) defects were derived from providers in the pre-analytic phase who passed the defect onto SP where they were detected and corrected. 12 (2.4%) defects resulted in generation of amended reports.

Conclusions: With careful surveillance, we have uncovered a baseline defect rate that is nearly 1 out of 3 cases moving through the SP laboratory. Although alarming, this is not to be misconstrued as a tabulation of defects of a diagnostic nature that would have impacted patient care. Rather, this is a reflection of the amount of waste in the SP system requiring correction with resultant re-work and time delay before an acceptable product could be released. These data confirm that the most common defects and corresponding waste encountered in SP are generated within rather than passed onto the laboratory. Heretofore, this inefficiency was quietly recognized, corrected and passed on within in the supply chain without being made visible as a focus of process improvement activities.

1552 A Laboratory Based Quality Assurance Program for Monitoring D-dimer Assays

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Background: D-dimer (DD) assays are valuable screening tools in ruling out the diagnoses of pulmonary embolism (PE) and deep vein thrombosis (DVT) in low-risk populations. A laboratory-based management system for optimizing utilization of these assays has not been previously described. We therefore developed an integrated laboratory information (LIS) and physician-order-entry (POE) system to accomplish the above.

Design: The laboratory system database at our medical center was searched for all DD assays ordered in the Emergency Department from 1/1/05-6/19/06. Charts of patients with positive results (≥1.5 mg/L) were reviewed. The pre-test risk assessments, presenting symptoms, additional diagnostic investigations, and outcomes were recorded.

Results: DD tests were ordered for 1155 patients suspected of PE/DVT, with 570 ≥ 1.5 mg/L, or positive, and 585 < 1.5 mg/L, or negative. After further investigation, 48/570 with DD ≥ 1.5 mg/L had documented PE/DVT. In those with DD < 1.5 mg/L, none were diagnosed with PE/DVT, yielding a sensitivity and specificity of 100% and 52.8% respectively. Prior to pretest risk assessment being required by the POE system, 135 patients had DD ≥ 1.5 mg/L. Of these, 9/135 (7.4%) tested positive for PE/DVT. After the POE system was modified to require a pretest risk assessment be entered, 435 patients had DD ≥ 1.5 mg/L: 242 low risk; 63 mod/high risk; and 130 with risk level not found. A diagnosis of PE/DVT was made in 14/242 (5.8%) low risk, 14/63 (22.2%) mod/high risk, and 11/130 (8.5%) of those with no risk level assigned. One or more diagnostic imaging studies were performed on 408/570 patients with DD ≥ 1.5 mg/L, while 162 patients with DD ≥ 1.5 mg/L had only a CXR or no imaging. Thirty-five patients had a DD result between 1.5 – 1.59 mg/L. PE/DVT was diagnosed in one of these patients (1.59 mg/L). A total of 187 patients had a primary diagnosis of PE/DVE during the time of the study. Forty-eight of 187 were tested for DD.

Conclusions: Incorporation of directive and educational materials into the POE and LIS to guide clinician decision-making in utilizing the DD assay decreased the ordering of imaging tests for mod/high risk patients by over 66%. In conclusion, a monitoring and educational program based on a medical information system, permits the evaluation and adjustment of cut-off values to allow for more appropriate use of DD assays.

1553 The Effect of Biopsy Length on Trephine Biopsy Quality in Multiple Myeloma and Non-Myeloma Patients

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Background: A high quality trephine bone marrow (BM) biopsy is an important component in the diagnosis of hematologic diseases. Review of quality assurance data for multiple myeloma (MM) and non-MM patients at 2 academic institutions has shown an increased rate of unsatisfactory biopsies from MM patients.

Patient Group	Biopsy Length				
	< 0.5cm	0.5 - < 1.0cm	1.0 - < 1.5cm	1.5 - 2.0cm	> 2.0cm
Non-MM Cases	21% (5/24)	64% (86/135)	89% (117/138)	91% (50/55)	100% (8/8)
MM Cases	33% (3/9)	50% (12/24)	68% (25/37)	70% (30/43)	92% (22/24)

Table 2. Adequacy Rate: Percentage of biopsies with at least 4 intact marrow spaces as a function of biopsy length.

In attempt to find ways to improve diagnostic material, this study evaluates the effect of BM biopsy length on adequacy in MM and non-MM patients.

Design: 408 consecutive BM biopsies from Institution #1 and 83 consecutive MM BM biopsies from Institution #2 were evaluated for BM biopsy length and number of intact marrow spaces. Length was measured on the microscopic slide, and when multiple fragments were present, a sum of the lengths was calculated. An arbitrary designation of 4 intact BM spaces was used to define the minimum content of an optimal biopsy.

Results:

	Institution #1	Institution #2
Non-Myeloma Cases	N = 354	N = 490
- Unsatisfactory	18 (5%)	34 (7%)
Multiple Myeloma Cases	N = 54	N = 1,944
- Unsatisfactory	6 (11%)	279 (14%)

Table 1. Biopsy quality comparison for Institutions #1 and #2. Unsatisfactory is defined as no intact marrow spaces within a trephine biopsy.

Conclusions: Unsatisfactory BM biopsy rates (Table 1) suggest the disease process associated with MM results in a higher incidence of suboptimal biopsies. Biopsy length data (Table 2) shows MM BM biopsies require a longer length to achieve an adequacy rate similar to non-MM BM biopsies. When designating 4 or more intact marrow spaces in a trephine biopsy as the minimal volume for diagnostic adequacy, a total biopsy length of at least 1.0 cm should be sought in non-MM patients and 2.0 cm in MM patients to have a high likelihood (>85%) of a quality biopsy. Achieving these goals may decrease the need for repeat procedures.

1554 Experience with Prostate Needle Biopsies (PNB) in a Specialized Urologic Pathology Laboratory ("Condo Laboratory")

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Background: New models of practices have appeared in different medical specialties. In pathology, along with traditional private and academic settings, new joint ventures in which physicians groups share in profits for pathology services exist. These types of practices are referred to as "condo laboratories". National pathology associations have expressed concerns about the quality of pathology services provided in these laboratories. The aim of this study was to examine the results of objective parameters for PNB in a "condo laboratory" compared to earlier published data in the pathology literature.

Design: This is a retrospective study evaluating the results of prostate carcinoma detection of 12 biopsies obtained by TRUS performed by 40 urologists in five practices during the period from July 2005 to July 2006 evaluated in a specalized urologic pathology lab. The PNB were taken from the peripheral zones of the right and left lobes. The biopsy results were compared to the incidence of Prostatic Carcinoma (PC), High Grade Prostatic Intraepithelial Neoplasia (HGPIN), Acinar Atypia (AA) and Benign. The diagnosis results were also compared to second opinion consultations requested by clinicians/patients and submitted to outside institutions.

Results: In this study a total of 2608 cases of PNB and 62,123 slides were examined. The results were the following : 972 PC (37.2%), 398 HGPIN (15.2%), 49 AA (2.0%),1189 benign (45.6%). A total of 110 cases (4.2%) were requested for second opinion. Agreement was seen in 91% of the consultations. Disagreement was seen in 9 cases (9.1%). Of the cases of disagreement 6 cases were cases of HGPI vs benign, 1 was a case of AA vs HGPIN and 2 cases between AA and PC. In these two cases our initial DX of carcinoma were confirmed by a second PNB and a third outside opinion respectively. Our number of carcinomas detected (37.2%) was higher than in most publications, but was similar to studies with 12 PNB, were (38.6%) of patients show PC.Our incidence of AA is lower than 5% reported. HGPIN is higher from the mean of 7.6% published but still within the numbers of 15% and 16% reported by other centers.

Conclusions: The number of PC, AA and benign DX are in accordance with results in the literature. HGPIN is higher than the mean. A 12 core biopsy strategy for TRUS-guided biopsy of the prostate gland improves detection and histologic grading of prostate carcinoma. The parameters did not show marked discrepancies between the condo lab and other institutions. There is agreement on most of the second opinions.

1555 Improving Interobserver Reproducibility in Pap Test and Cervical Biopsy Interpretations

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Background: Interpretive variability is substantial for Pap test and histopathologic cervical specimens, and lack of agreement and standardization results in diagnostic errors and over and under treatment. Our goal was to determine the efficacy of specific interventions in improving interpretive reproducibility in cytotechnologists and pathologists.

Design: A total of 38 cytotechnologists and 52 pathologists from 5 labs established baseline reproducibility in interpreting Pap test and cervical biopsy specimens, performed interventions to improve, and then re-measured reproducibility using standardized slide study sets. Interventions were lab-specific, interactive and non-interactive, varying from one-on-one discussions and multi-head microscope conferences to didactic lectures. Interactiveness of individual interventions was graded on a 1 to 8 scale. We measured the differences between pre and post-intervention κ for pairwise agreement of lab cytotechnologists, cytologists, and surgical pathologists.

Results: Individual lab cytotechnologist, cytopathologist, and surgical pathologist pre and post-intervention site specific median κ values were 0.52 and 0.58, 0.52 and 0.46, and 0.53 and 0.48 respectively. The number of labs that showed post-intervention improvement in cytotechnologist, cytopathologist, and surgical pathologist agreement was 4, 1, and 1, respectively. Lab cytotechnologists who improved their interpretive reproducibility used interactive interventions (> score 3), and non-interactive interventions either resulted in lower or no change in interpretive reproducibility. Many surgical pathologists strongly resisted reproducibility evaluation.

Conclusions: Interpretive reproducibility of cervical specimen diagnoses may be improved, and improvement necessitates interactive interventions that appear to be more acceptable to cytotechnologists than pathologists. Current pathologist culture is a major barrier to designing and implementing effective interventions to improve interpretive reproducibility.

1556 Columnar Cell Lesions: Consensus of Diagnosis among Pathology Trainees

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Background: Columnar cell lesions (CCLs) of breast are being increasingly identified in breast biopsies for microcalcifications. CCLs include columnar cell change, columnar cell hyperplasia and columnar cell lesions with atypia. CCLs with atypia are associated with a similar risk of developing invasive breast carcinoma as atypical ductal hyperplasia. A recent study looked at the ability of a group of breast pathology experts to reach a

consensus on CCLs with atypia. How pathologists in the real world do is not known. We studied a group of pathology trainees as a model for the impact of a training tutorial on the ability to distinguish various types of CCLs.

Design: Twenty-four slides including lesions of columnar cell change (8 slides), columnar cell hyperplasia (8 slides) and CCLs with atypia (8 slides) were prepared and reviewed by two senior pathologists (JYR and MRS). Fourteen residents and fellows reviewed these slides at a multiheaded microscope before and after a training tutorial on the criteria of three CCLs. The criteria for the CCLs are summarized in Table 1.

Results: The agreement on columnar cell change, hyperplasia, and atypia was 71.1%, 60.7%, 58.9% and 79.4%, 51.8%, 71.3%, before and after a training tutorial respectively. The agreement of columnar cell lesions was 64.6% and 67.3% before and after the training tutorial with minimal increase of agreement after tutorial. The agreement (more than 70% agreement) on individual cases of CCLs is summarized in Table 2.

Conclusions: The recognition of columnar cell lesions can be challenging, The initial agreement among pathology trainees was not high with only 58.9% in CCLs with atypia. Appropriate turorial training can increase the recognition of columnar cell lesions agreement among the pathology trainees and presumably pathologists in practice.

Table 1 Diagnostic Criteria for CCLs

Columnar cell change	Columnar cell hyperplasia	CCLs with atypia
TDLU with dilated acini	TDLU with dilated acini	TDLU with dilated acini
TDLU lined by columnar cells (1-2 layers)	TDLU lined by columnar cells (more than 2 layers	TDLU lined by columnar cells (more than 1 layer)
Uniform cells, elongated to ovoid nuclei which are perpendicular to the BM, absent or inconspicuous nucleoli	Same as seen in columnar cell change	Round or ovoid nuclei with nucleoli and loss of polarity
Apical snouts present	Apical snouts present	Apical snouts present

Table 2 Agreement on Diagnosis of All CCLs Before and After Training Tutorial

% of Agreement	100	90	80	70
Pre-training (cases)	1	5	9	12
Post-training (cases)	5	8	12	15

1557 Critical Values in Surgical Pathology: A Retrospective Study To Establish Guidelines for Communication of Urgent Results

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Background: Recent attention has shifted toward defining critical values in surgical pathology, as used in clinical pathology for critical diagnoses, which require urgent physician notification. The Association of Directors of Anatomic and Surgical Pathology (ADASP) recently proposed a schema for critical values in surgical pathology.

Design: Our department established a policy defining the timely communication and documentation of urgent surgical pathology findings. To monitor the effectiveness of this policy and to refine a customized list of critical values for surgical pathology, we analyzed the surgical pathology reports for a six-month period for proper documentation and communication of critical values.

Results: Of the 26,385 general surgical pathology cases examined, not including gynecologic pathology and cytology, 884 cases (3.4%) prompted urgent physician notification. In over half of the cases (574, or 64.9%), the physician was contacted by telephone within 24 hours of receiving the specimen and the notification was documented in the report. 305 of the 884 (34.5%) cases fell into one of the recently proposed critical values categories (Am J Surg Pathol 2006; 30: 897-899). Of these, the diagnosis of 142 cases had immediate clinical consequences (40 crescentic glomerulonephritis; 100 transplant rejections; 2 vasculitis), 149 cases had unexpected or discrepant findings (7 frozen section discordance; 142 unexpected malignancy), and 38 cases had infection. The other 579 (65.5%) cases had conditions that were not specified in the ADASP list, but nonetheless justified immediate notification of the physician. These conditions included heart transplant biopsies without rejection (127) as per local requirement, abnormal heart biopsies (79), acute tubulo-interstitial nephritis (72), graft-vs-host disease (8), amyloidosis (11), diverse kidney biopsy diagnoses (138), cases ordered as rush by the attending clinicians (36), and the remaining 108 cases for a wide variety of reasons.

Conclusions: The timely communication and documentation of unexpected surgical pathology findings is an important measure to improve patient safety. The current critical values list set by the ADASP may need to be customized to address all the potential diagnoses necessary for physician notification in a given institution. We recommend adding graft-versus-host disease, acute tubulo-interstitial nephritis, and all transplant cases to the critical values list for surgical pathology.

1558 Assessment of the Mentoring Needs for Faculty Development in Anatomic Pathology

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Background: Faculty development programs in academic medicine often declare that mentoring is critical for success. Mentoring programs described in the literature do not usually address the needs and expectations of the faculty in planning the initial program. This study utilized a survey to assess attitudes about mentoring at both junior and senior levels, in a large academically oriented group pathology practice, in preparation for designing a structured mentoring program.

Design: The survey instrument included 29 items related to mentoring. Questions about attitudes included whether mentoring is important to career development and in what specific areas a mentor should help a mentee. The respondents were also asked about areas in which they would like professional development training. The results were tabulated and analyzed. All 25 anatomic pathology faculty were given the opportunity to participate in this entirely anonymous survey.

Results: The return was 80% for the survey (20/25). 50% of respondents had less than 10 years of faculty experience. 89% believed that mentoring is important in the early career. The majority indicated that mentors should assist the mentee with the following: assessing strengths and weaknesses (95%), guiding career choices (95%), providing mentees with opportunities (100%), facilitating networking (100%), helping with writing grants and papers (84%), advocating on the mentee's behalf (100%), reviewing the mentee's progress (94%), helping mentee set goals (100%), helping mentee prepare performance reviews (89%). Most respondents believe mentoring program should include one-on-one sessions and some formal training sessions. The majority of respondents, regardless of their level of experience, reported wanting development in skills such as negotiation, time management, communication, public speaking, leadership, management, grant-writing, scientific writing, budgets, teaching, and mentoring.

Conclusions: Mentoring is a critically important initiative for supporting faculty career development, especially in the early career period. The areas in which faculty believe a mentor should assist a mentee are broad, suggesting a need for more than one mentor per mentee. Interestingly, faculty at all levels of experience reported an interest in further developing specific skills. A plan which integrates professional development training into a mentoring program will provide concrete benefits to both the mentee and the mentor.

1559 Subspecialization in Intraoperative Consultation (IOC) Increases Patient Safety in a Tertiary Care Setting: A Gynecologic Pathology Model

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Background: There is evidence to support that pathologists' subspecialization in tertiary care facilities increases patient safety. It is not yet established whether IOC should be rendered by the pathologists dependent on the areas of their subspecialization. The aim of this work is to present our gynecologic pathology model as an attempt to objectively assess the value of subspecialization in IOC.

Design: In our department, there is a subspecialized group of gynecologic pathologists who handle the great majority of IOCs rendered to gynecologic oncologists. They play a minor role in the IOC service for general gynecologists. Surgical pathology database and medical records were searched in the period of July 1990 to June 2005 for all gynecologic pathology cases with IOC. Two gynecologic pathologists validated the data and entered it in a database with special emphasis on IOC accuracy and the incidence of adverse events (AEs).

Results: A total of 731 IOCs were identified, rendered for 662 patients (average 1.2 per patient). Of the 339 IOCs rendered by gynecologic pathologists, 304 (89.7%) were concordant with the final diagnosis, 34 were discordant and 1 case was deferred. The general pathologists were consulted 392 times where the IOC was concordant with the final diagnosis 341 times (87.0%), discordant 48 times and was deferred 3 times. The difference of the concordance rate between the two groups was not statistically significant by Chi-square test ($p = 0.394$). Discordance in the gynecologic pathologists group was interpretational in 18 and due to sampling in 16 incidents. In the general pathologists group it occurred in 27 and 21 incidents respectively. The difference in the likelihood for interpretational errors between the two groups was not statistically significant by Chi-square test ($p = 0.766$). Of the 731 IOCs, AEs occurred in 14 cases (1.9%) 2 were given by gynecologic pathologists and 12 by general pathologists.

Conclusions: IOC rendered by the pathologists dependent on the areas of their subspecialization in the gynecologic pathology model provides a safer practice. Although the overall accuracy rates are higher when a subspecialist renders the IOC, the differences with that of the generalist's was not statistically significant. More importantly is that the AE rate is significantly lower when subspecialists handle the IOC.

1560 Evaluation of Critical Diagnoses in Kidney Pathology

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Background: Guidelines recently established by the Association of Directors of Anatomic and Surgical Pathology (ADASP) for critical values represent an effort to foster accuracy and timeliness of reporting in surgical pathology and improve patient care. Critical diagnoses in renal pathology that require immediate physician communication represent a significant fraction (25%) of the total number of notified surgical pathology cases in our department.

Design: The Division of Renal Pathology has established over the preceding years guidelines for proper documentation and communication of critical diagnoses with the attending clinicians. In order to evaluate the effectiveness of these guidelines, we analyzed retrospectively all kidney biopsies received over a six-month period, which represents 695 of a total of 26,385 general surgical pathology cases.

Results: Of the 695 kidney biopsy results, 218 cases (31.4%) required urgent notification, and 148 cases (67.9%) were communicated to the treating physicians within 24 hours based on the findings of the light and immunofluorescence microscopy. The remaining biopsy results were communicated after critical information of the electron microscopy findings were available, usually within 72 hours. The more common diagnoses that were considered justified for immediate notification are listed in the table below.

Conclusions: Many critical diagnoses in renal pathology require immediate communication with the attending nephrologists. We propose additional diagnoses in the guidelines set forth by ADASP in the hope to improve patient care and safety. We suggest the list of critical diagnoses should be customized in accordance with the need of and in consultation with the practicing nephrologists within any given institution.

Critical Diagnoses for Kidney Pathology

Critical diagnoses	# of cases
Crescentic glomerulonephritis (CrGN):	
-Anti-GBM disease (CrGN)	2
-Immune complex mediated (CrGN)	26
-Pauci-immune (CrGN)	12
Allograft biopsies:	
-Acute rejection (cellular/humoral)	34
-No rejection	7
-Polyoma/BK virus infection	10
Acute tubular injury	43
Active interstitial nephritis	29
Acute vascular injury:	
-Acute thrombotic angiopathy	10
-Vasculitis	5
-Atheroembolic disease	2
Complication of paraproteinemia	11
Obstructive uropathy	1
Collapsing glomerulopathy	23
Unexpected findings:	
-Neoplasm	3
-Other tissue in the biospy (colon, liver, spleen)	0
Total	218

1561 Variation in Diagnostic Immunohistochemistry (DIHC) Testing within a Multi-Hospital System

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Background: Wennberg and others have reported small geographic area variation in a number of clinical practices, such as operations performed and tests ordered. This variation exists even when patient populations are similar, indicating suboptimal utilization of clinical services. Our goal was to determine the frequency of DIHC test ordering in a multi-hospital system composed of different practice types.

Design: We used a retrospective review design to examine DIHC ordering practices in a hospital system composed of 12 unique pathology groups (4 academic and 8 community-based) for the 2004 calendar year. Overall, 196,777 cases were accessioned. Proportions of total cases examined with DIHC performed and average numbers of stains per case were calculated. The Chi-square test was used to examine differences in DIHC ordering practices by group setting, individual institution, pathologist, specimen type, anatomic site, and test panel. The correlation coefficient was used to examine relationships between inter- and intra- institutional diagnostic malignancy rates and case mix (based on current procedural terminology [CPT] codes) and number of DIHC stains.

Results: The frequency of DIHC use was hospital and practice type dependent ($P < 0.001$) with academic and community hospitals ordering DIHC in 10.4% and 2.0% of cases, respectively. DIHC ordering within these groups was highly variable with one academic hospital ordering DIHC in 18.5% of cases and several community hospitals ordering DIHC similarly to academic hospitals. The mean number of stains per case was variable across academic hospitals (range: 2.7 to 5.8 stains) and community hospitals (range: 0 to 11.9 stains) ($P < 0.001$). The hospital frequency of DIHC use correlated with malignancy frequency and case mix; however case mix and/or malignancy frequency could not fully account for variable interinstitutional ordering patterns. For example, academic and community hospitals ordered DIHC in 29% and 19% of prostate needle biopsy cases ($P < 0.001$) respectively, even though the proportion of malignant cases was similar. Pathology groups ordered different DIHC panels for the same scenario; for example, to diagnose metastatic melanoma, one hospital ordered AE1/3, S100 and HMB45 and a second hospital ordered MelanA and S100.

Conclusions: We found high variation in DIHC ordering practices across a diverse group of hospitals in the same medical system. This variability indicates a lack of standardization and suggests the existence of suboptimal use in a yet undetermined portion of cases.

1562 A 15-Year Audit of Intraoperative Consultation (IOC) for Pancreatic Tumor Surgery in a Tertiary Care Centre

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Background: Resection of pancreatic tumors is usually planned based on clinical judgment and imaging findings with a diminishing role for a preoperative biopsy. It is a major procedure during which a pathologist is consulted without having a prior tissue diagnosis that could be used as a reference. We summarize our experience at a tertiary care hospital with emphasis on accuracy and confidence level.

Design: Surgical pathology database and medical records were searched in the period of 1990 - 2005 for all cases with pancreatic diseases. Only data related to surgeries performed for pancreatic tumors were collected. The subgroup of patients who had IOC requested was further analyzed.

Results: IOC was requested in 141 of 183 (77%) patients. It was concordant with the final diagnosis in 127 cases (90.1 %) and discordant in 14 cases (9.9 %). In 3 cases, the status of the margins was overcalled resulting in excision of additional tissue. Overcalling of tissue diagnosis occurred in 2 cases and that of extra pancreatic spread in 1 case; all three cases were adequately managed due to the surgeon's clinical judgment. In 4 pancreatic adenocarcinomas, the status of the margins was undercalled with subsequent recurrence in 1-4 months and patients' death in 5-12 months. In one patient with endocrine tumor the surgical margin was undercalled but the patient is alive and well 120 months postoperatively. Undercalling of tissue diagnosis occurred in 2 cases that were nevertheless surgically unresectable. Extra pancreatic spread was undercalled in one patient whose tumor recurred in 3 months. The rendered IOC was definitive in 123 cases (87.2 %), non-definitive in 17 cases (12.1 %) ("favoring" one diagnosis in 9 and using the word "suspicious" in 8), and was deferred in 1 case (0.7 %). In cases with non-definitive IOC, surgeons based their subsequent decisions on the rendered diagnosis disregarding the word "favor" or "suspicious" in 13 cases while they considered the given disclaimer in 4 cases where additional samples were submitted to reach a definitive diagnosis.

Conclusions: In our hospital, IOC has a 90.1 % accuracy rate. A false positive reporting of the surgical margin did not significantly impact outcome while the false negative reporting of the surgical margin or extra pancreatic spread had grave consequences. When circumspect terminology is used in reporting frozen section diagnoses, surgeons are likely to proceed based on the rendered diagnosis disregarding its disclaimer.

1562.5 Fellowship Trends in Pathology Residents

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Background: Recent changes in pathology training requirements to shorten training time will likely impact the choices that residents make for post-residency fellowship training. Residents' motivations, expectations, and ultimate goals regarding fellowship training programs and career are not well understood. This study assessed attitudes towards post-residency training and career in a group of residents from different programs across the country.

Design: An anonymous survey instrument was developed and sent out via Survey Monkey (www.surveymonkey.com). The survey included questions pertaining to fellowship choices, concerns about the future, and motivations for pursuing fellowships. The survey was sent to 234 residents, based on their membership in the CAP Residents Forum and the ASCP Resident Liaison Network. Participants were also asked to forward the link to their resident colleagues.

Results: 213 responses were received from at least 40 different residency programs. The distribution of post graduate years was approximately even. 93% were in AP/CP combined programs and 76% were training in large academic centers. 68% of the respondents planned or favored a private practice career. 89% of the respondents planned to do a fellowship. 72% and 27% planned to do one and two fellowships, respectively. The most common first choice fellowship was general surgical pathology (26%), followed by cytopathology (16%), hematopathology (15%), gastrointestinal pathology (10%), dermatopathology (8%), and forensics (5%). Respondents indicated the most important reasons for pursuing a fellowship included development of expertise (93%), job connections and networking opportunities (55%), and working with known experts (49%). The least important factors were research and publishing opportunities (9%) and experience in practice management (10%) and frozen section (13%). Residents reported that they obtain most information about fellowship programs from the internet; the most important sources were program web sites (70%) and the ACGME web site (43%).

Conclusions: Understanding resident attitudes and expectations will help to maximize quality of post-residency training. The vast majority of residents are planning to pursue at least one fellowship, either in boarded subspecialties (54%), general surgical pathology (26%), or non-boarded subspecialties (15%). The most common reason for pursuing fellowship training was to gain expertise, and the least common was research. Interestingly, most applicants get their information from program web sites, suggesting that up-to-date web sites will be an important recruiting tool for fellowship programs.

1563 Immunohistochemical Analysis of Estrogen (ER) and Progesterone Receptor (PR) Status in Breast Carcinoma (BC): Comparison of Diagnostic Concordance between Pathologists

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Background: Determination of ER and PR status is critical in the management of BC patients. ER and PR analysis by immunohistochemistry (IHC) in formalin-fixed, paraffin embedded (FFPE) tissue is the standard of care in the pathologic evaluation of BC. The subjective nature of IHC interpretation may at times lead to inaccurate receptor status and inappropriate treatment.

Design: Diagnostic interpretation of ER and PR IHC was compared between a single pathologist with expertise in IHC (EP) and ten general pathologists (GP) with varying IHC experience. A prospective series of 100 consecutive breast carcinoma cases were studied. ER and PR IHC on FFPE sections were reviewed by light microscopy and the percentage of cells with nuclear immunoreactivity semi-quantitatively assessed. IHC slides were graded: positive, negative, and focal positive for tumors showing only focal positive nuclear staining of tumor cells and/ or weak staining intensity of tumor cell nuclei, overall, < 5% immunoreactivity. ER and PR IHC slides were reviewed independently and recorded, first by the attending GP and then on blind review by the EP.

Results: Of the 100 cases, there was 91% agreement for both ER and PR. 21 and 27 cases were negative for ER and PR, respectively for both observers. There were a total of 18 discrepancies. For ER: 4 cases were negative by GP but positive by the EP. Three focal positive cases by GP were positive by EP. Thus, there were 6 cases with discordance between positive and negative for the GP and EP. For PR, there was 96% concordance between positive and negative. Three cases were negative by GP but positive by the EP and 1 case was negative by GP and positive by the EP. Five focal positive cases by GP were positive by EP.

Conclusions: Concordance between GP and EP was 94% and 96%, respectively for ER and PR. For both ER and PR similar rates of discordance between negative by GP and positive by EP were observed (4 and 3%) as well as focal positive by GP and positive by EP (3 and 5%). Although subjective interpretation and technical variations may limit the ability for widespread accurate quantitation in an inherently qualitative test, our results show a high concordance rate between GP and EP. However, discrepancies of 4-6% may yet have significant clinical impact on patient treatment and therefore survival. Thus, these results may not be acceptable for a diagnostic IHC test that determines therapy.

1564 Mandatory Second Opinion in Surgical Pathology Referral Material

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Background: Second opinion pathology is a method of quality assurance intended to expose clinically significant interpretive errors that have a direct impact on patient management. Prior to treatment of referred patients, our institution requires in house second opinion of histopathologic diagnoses made at outside institutions. We sought to determine whether this is a useful quality assurance tool at our academic medical center, and to characterize interpretive differences with respect to anatomic site.

Design: Review of 3410 mandatory second opinion surgical pathology cases at the University of Iowa Hospital and Clinics from April 2004 to June 2006. Each case was prospectively classified as no diagnostic disagreement, minor diagnostic disagreement, or major diagnostic disagreement by the second opinion pathologist at the time of referral. A major diagnostic disagreement was defined as a discordant diagnosis with potential for significant change in treatment or prognosis. Major diagnostic disagreements were classified into organ systems and also according to the clinical significance of the changed diagnosis based upon follow-up chart review.

Results: Of the 3410 cases reviewed, second opinion surgical pathology resulted in 84 (2.5%) major diagnostic disagreements and 275 (8.1%) cases with minor diagnostic disagreements. 24 (28.6%) of the cases with major disagreements were from the female reproductive tract, 17 (21.4%) were from the gastrointestinal tract, 17 (20.2%) were skin cases, 9 (10.7%) were from the head and neck, 5 (6.0%) were prostate cases, 4 (4.7%) were from the kidney or bladder, and the remaining 7 were from breast (3), lymph nodes (2), muscle (1), and soft tissue (1). Of the 84 cases with major diagnostic disagreements, 45 (1.3% of total cases reviewed) prompted changes in the clinical management and therapy as a result of the second opinion diagnosis.

Conclusions: Mandatory second opinion identified clinically significant discrepancies in a small percentage of general surgical pathology cases, however over 50% of these changed diagnoses significantly altered clinical management. These findings support the idea that mandatory second opinion is a useful quality assurance tool in the referral setting.

1565 A Comparison of Sampling Techniques in the Pathological Staging of 222 Radical Prostatectomy Specimens

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Background: The current lack of standardized processing in the evaluation of radical prostatectomy specimens has resulted in a wide variation of submission protocols. Some institutions choose to submit representative sections (RS), including apex, base of the seminal vesicles and proximal and distal margins. According to the ASCP, only 12% of laboratories surveyed submit the entire specimen (ES) for microscopic examination. In an era of limited healthcare resources, the goal is clearly to obtain diagnostic accuracy using the fewest number of blocks. We compare the efficacy of these two sampling methods in detecting diagnostic and prognostic factors.

Design: A total of 222 radical prostatectomy specimens diagnosed as adenocarcinoma were processed at our institution from 2001-2006. Since 2004, our department has submitted 110 consecutive ES cases. A CoPath database search identified a matching number of RS cases. We reviewed the surgical pathology reports for diagnostic and prognostic factors that directly affect staging and clinical management, including capsular penetration, positive margins, PIN, and lymphovascular and perineural invasion.

Results: The patients ranged from 40 to 78 years of age (mean 60y). The prostate specimens ranged from 15.5 to 150 grams (mean 43g). Of the 112 RS cases (mean 20 blocks), 21% showed extraprostatic extension, 43% had positive surgical margins, 79% demonstrated perineural invasion, and 2% showed lymphovascular invasion. Of the 110 ES cases (mean 39 blocks), 40% showed extraprostatic extension, 36% had positive surgical margins, 82% demonstrated perineural invasion, and 8% showed lymphovascular invasion. PIN was identified in 99% of ES cases, compared with 85% of RS cases. The mean total Gleason score (6.92 ES, 6.95 RS) was nearly identical in the two groups.

Conclusions: Clinicians depend on the pathology report for accurate diagnosis and staging, which guide them in determining appropriate treatment recommendations. Thus, uniformity in specimen processing and reporting is essential. We found that complete submission of the prostate gland in radical prostatectomy specimens identified extraprostatic tumor spread twice as often when compared with cases evaluated by representative sampling (40% ES, 21% RS), a finding that escalates the tumor stage from pT2 to pT3 (AJCC) and may prompt neoadjuvant therapy. We feel that a larger study is warranted and that entire submission of the gland may be appropriate for accurate reporting of adenocarcinoma of the prostate.

1566 Inter-Institutional Agreement in the Application of a Taxonomy Classifying Two Types of Pathology Error

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Background: Previous classifications of pathology errors have been incomplete, inconsistent and institution-specific. In this study, we validate across several institutions a classification of defects found in amended pathology reports and in cytological-histological (CH) non-correlations.

Design: A four-part classification of 1-mis-identification, 2-specimen defects, 3-mis-interpretation, and 4-report defects was developed by studying cases of pathology report emendation and its reproducibility previously confirmed within a single institution. Next, the taxonomy was applied to a second genre of pathology defects (CH non-correlation) and a fifth category (indeterminate discrepancy) was added. Finally, 15 defects causing amended reports and 15 instances of apparent CH non-correlation were assembled from the case files of 2 institutions, de-identified, and circulated to pathologists at 7 institutions. The kappa statistic assessed the degree to which the pathologists agreed in their classifications. Disagreements in classifications were discussed. A second panel of 30 cases, half occurring in report emendation and half CH non-correlation, was subjected to a second classification effort and kappa assessement.

Results: In the first scrutiny, the median kappa was 0.647 [range 0.439-0.856] and in the second 0.651 [range 0.334-0.950]. Thus the median kappa showed good correlation. The agreement did not change with the inter-scrutiny intervention, but the range of inter-observer variation was wider in the second, compared to the first scrutiny. Individual observer pairs also reviewed remarkably consistently across the two classification events, but pairs with the highest agreement at the initial event, in general, regressed toward the mean in the second event, while those with the worst initial agreement further deteriorated; those with moderate agreement generally improved.

Conclusions: If one rates kappa values of 0-2 as 'poor' 2-4 'fair', 4-6 'moderate', 6-8 'good' and 8-10 'excellent', then the inter-institutional classification agreement demonstrated here is consistently 'good' as applied to two panels of defects, those leading to amended reports and instances of apparent CH non-correlation. The intervention between the 2 classification events of discussion of cases causing dissonance failed to achieve improvement. A pedagogical intervention between the classification events did not significantly affect agreement.

1567 Intraoperative Cytology in the Diagnosis of Pulmonary Specimens: A Retrospective Review

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Background: Studies show that, in most surgical specimens, intraoperative cytology yields diagnostic accuracy comparable to frozen sections . The aim of this study is to assess the accuracy of the use of intraoperative cytology in the evaluation of pulmonary specimens.

Design: At our institution, a Diff-Quik stained smear is examined initially, with a frozen section prepared only if the smear is equivocal. We retrospectively reviewed the files for all pulmonary intraoperative consultations (IOC) performed at our institution between 2002 and 2005. The intraoperative cytologic diagnosis was compared to the final histopathological diagnosis (FHD). An IOC diagnosis was classified as discrepant if, in the case of malignancy, the IOC cytology and FHD disagreed; or in benign cases, if an entity requiring tissue submission for additional diagnostic studies was missed or misidentified. Discrepant cases were analyzed to identify commonly missed diagnostic entities.

Results: A total of 839 IOCs were retrieved. A malignant diagnosis was rendered in 278 IOC specimens and a benign diagnosis in 561 specimens. Discrepancies between the IOC and FHD were identified in 75 specimens.

Comparison of FHD and IOC Cytology

FHD	Correct IOC	Discrepant IOC	Total
Malignant diagnosis	239 (86%)	39 (14%)	278 (100%)
Benign diagnosis	525 (94%)	36 (6%)	561 (100%)
Total	764 (91%)	75 (9%)	839 (100%)

Granulomas were present in 66/ 561 benign specimens. All 36 discrepancies in benign FHD were accounted for by granulomas that were missed by IOC cytology and identified during FHD or were misidentified during IOC and were absent in the FHD amounting to 55% (36/66) discrepancy rate. Twenty nine (29) of the 36 specimens had IOC cytology only.

Conclusions: In conclusion, IOC cytology of pulmonary specimens appears to be more suitable in differentiating benign from malignant disease than in its ability to detect granulomas. When an infectious or granulomatous process is suspected, a frozen section may improve the diagnostic accuracy, and help in guiding intraoperative handling of additional specimens for further diagnostic studies.

1568 Retrospective Peer Review of Diagnostic Bladder Biopsies: Experience within a "Center of Excellence" Model

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Background: In many institutes, all or a subset of cases are reviewed routinely by a second pathologist within the same department as a method of quality assurance. Studies have shown that error rates range from 0.26% to 1.2% for global in-house prospective review and 4.0% for retrospective blinded review. These errors may be major, minor or clerical. The objectives of the current study were to perform a retrospective review of diagnostic bladder biopsies in our clinical practice, which is primarily a subspecialty-based academic setting.

Design: The surgical pathology files at our institute were searched for bladder biopsies with a diagnosis of carcinoma in situ (CIS), cystitis with atypia, cystitis with reactive changes or dysplasia for a one-year period. A total of 73 cases matching the search criteria were identified. Out of these, a total of 59 complete cases with 1 to 6 parts were available for review. The slides with final reports and review sheets were distributed to two pathologists with expertise in Genitourinary Pathology. The cases were distributed so that the reviewer was different than the original case pathologist.

Results: · Of the 59 cases reviewed, 19 were originally diagnosed as CIS, 34 as cystitis with reactive changes or atypia, and 6 with dysplasia · 56 reviews agreed with the original diagnosis. · 3 reviews were coded as Minor Disagreements (5%). · The Minor Disagreements included: 2 overcalls (CIS to Dysplasia) and 1 under call (Benign, reactive changes to Dysplasia).

Conclusions: Since we are a subspecialty-based sign out practice, we routinely do not have a second prospective review of cases and the value of this practice is not known. Prior to institution of this focused retrospective review of diagnostic biopsies, all our cases were subjected to a 5% global review by a second pathologist. In the current study, even though no major discrepancies were uncovered, the data indicates that minor disagreements do occur and it may be beneficial to have focused quality assurance studies based on the difficult or controversial areas of the subspecialty. This is particularly important in assessment of grading and staging information.

1569 Types of Frozen Section Errors and Deferal Rates in a Sub-Speciality Based Academic Surgical Pathology Practice

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Background: Many surgeons consider intraoperative frozen section examination as an important part of surgery, providing guidance to the surgeon about margin status and/or tumor type. Our hospital network has recently moved towards a speciality-based anatomical pathology signout. The impact of this specialization on frozen section accuracy is not well-characterized. Our overall objective was to quantitate the number and types of errors for a two year period and to examine the percentage of deferred cases annually for each of the sub-specialities.

Design: We reviewed the pathology records at our institution for all the frozen section examinations performed in a 2 year period (2004-2005). We compared the number and types of discrepancies, including sampling and interpretation errors that occurred over this time period .We also examined the number of cases which were deferred on the basis of sub-specialities. In select cases, the histological slides of the specimens submitted for frozen sections and the corresponding permanent section, were reviewed.

Results: Table 1 summarizes the errors and the deferred cases amongst the various subspecialities:

Frozen Section Errors and Deferals by SubSpeciality

Sub-Speciality	Interpretation Error (%)	Sampling Errors (%)	Deferals (%)	Total
Dermpath	1(25)	0 (0)	1 (25)	4
ENT	16 (1.2)	22 (1.6)	539 (39.4)	1369
GU	7 (2.3)	6 (2.0)	50 (16.7)	299
GI	17 (1.9)	10 (1.1)	143 (15.8)	904
GYN	10 (1.5)	10 (1.5)	106 (16.2)	655
Hemepath	4(2.9)	1 (0.7)	95 (68.8)	138
Neuropath	16 (1.7)	2 (0.2)	191 (20.1)	952
Perinatal	0(0)	0(0)	2(16.7)	12
Bone/Soft Tissue	14 (3)	2 (0.4)	72 (15.5)	466
Thoracic	24 (2.2)	9 (0.8)	166 (15)	1105
Transplant	6 (0.9)	3 (0.4)	49 (7.3)	675
Breast	7 (2.2)	16 (5)	12 (3.7)	318
Total	122 (1.8)	81 (1.2)	1426 (20.7)	6897

Conclusions: The overall error rate were 1.2 (sampling) and 1.8 (interpretation), both within the range of previously published error ranges in pathology. The deferrals in some sub-specialities were higher than others, probably related to specimen type. Some innovations have been introduced recently to reduce frozen section discrepancies include imaging the key slides which caused diagnostic difficulty and making them available as teaching tools. Secondly, the Division directors for the various pathology specialities examine the difficult cases and provide constructive feedback to the pathologists involved in the error. The overall goal is to reduce errors and number of deferrals.

1570 The Impact of a Monthly Anatomic Pathology Quality and Safety Conference on the Pathology Practice

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Background: A monthly Anatomic Pathology (AP) Quality and Safety Conference has been conducted in our department for the past 18 months. The conference is lead by the AP director with presentation of all cases in which there are issues such as amended diagnosis, major diagnostic disagreements, physician complaints, etc. The conference has a case presentation format including brief discussion and review of pertinent literature if necessary, and is attended by all the anatomic pathologists, residents and fellows.

Design: An evaluation of the outcomes of the conference was performed by classifying the cases presented into categories of types of problem and further action implemented, and comparing number of cases in each category for two 9-month time-periods during which the conference was held (0-9m, 10-18m).

Results: There were a total of 352 cases in which 167 were reviewed in the first time period and 185 in the second time period. Table 1 shows the issue types per time period and table 2 shows action implemented.

Table 1: Issue types

	1st Period	2nd Period
Terminology	14	25
Clerical	18	25
Incomplete report	16	22
Inadequate way of reporting	23	35
Inappropriate use of stains	5	9
Incorrect tumor classification	14	5
Incorrect tumor staging (TNM)	14	3
Incorrect tumor grade	3	2
Incomplete examination (gross/micro)	7	2
Incorrect outside diagnosis	4	5
Overcall / undercall of final report	22	28
Overcall / undercall of frozen section / FNA preliminary	6	5
Overcall / undercall of preliminary report	6	5
Other incorrect diagnosis, clinically significant	10	7
Other incorrect diagnosis, clinically insignificant	5	7

Table 2: Follow-up action

	1st Period	2nd Period
Amended report	53	43
Addendum	46	29
Reviewed and maintained original diagnosis	3	6
Comment in the diagnosis	5	5
Cytology-histology correlation	4	4
None	56	98
Physician contacted	22	18

Conclusions: There was marked improvement in the second period time with less cases of incomplete examination, incorrect tumor classification/staging, and other clinically significant incorrect diagnoses. Even though the total number of cases was higher in the second period, these were mostly due to terminology/clerical problems and inadequate/incomplete report. In many of these cases no further action was implemented, reflecting that the issues were minor. We concluded that the Monthly AP Quality and Safety Conference has not only been a valid educational experience, but has also improved the quality of our pathology practice.

1571 Quality Audit Comparing Sakura Tissue-Tek® Xpress® Rapid Tissue Processor and Conventionally Processed Pathology Specimens

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Background: To reduce surgical pathology turn-around-time of biopsies and large surgical specimens, Mount Sinai Hospital, Toronto, Ontario introduced the Sakura Tissue-Tek® Xpress® rapid tissue processor in April 2006. Following an implementation period of 3 months, a review was performed on the quality of the slides from cases processed by the rapid tissue processor to determine if the quality of the surgical pathology slides had been impacted by the implementation of the Tissue-Tek® Xpress®.

Design: 50 rapidly processed surgical pathology cases were compared to 50 matched cases that had been routinely processed in the same time frame. The quality of processing, cutting and staining and an overall assessment for each case was rated as either poor (1), fair (2) or good (3). The review was performed independently by two staff pathologists who were blinded from the processing method. Cases in which any one of the 4 categories was judged as good by one pathologist and poor by the second underwent a re-review by both pathologists. This final re-review score was used in the final analysis.

Results: Following the initial review, 13 cases (13%) underwent a second re-review. Following second review only 1 case had a category that was ranked poor by one pathologist and good by another. The rapidly processed cases scored lower in all four categories (processing 2.42 vs. 2.8; cutting 2.57 vs. 2.74; staining 2.4 vs. 2.92 and overall 2.34 vs. 2.81). The difference in assessed processing, staining and overall qaulity was statistically significant ($p < 0.001$). The difference in the cutting quality was not statistically significant ($p = 0.116$). No case scored poor in every category and no case was determined to be undiagnosable. The outcome in rating of the two procedures was essentially the same for the two pathologists.

Conclusions: The quality of cases processed using the Sakura Tissue-Tek® Xpress® rapid tissue processing system appears to be lower than those processed using conventional methods. The decision to implement this rapid processing system should be subject to a trade off of the improved turn-around-time and the reduced quality of the histopathology.

1572 Conversion to SurePath™ Liquid-Based from the Conventional Pap Smear: Preliminary Finding of an Ongoing Cost-Effective Study

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Background: Clinical application of cytological screening using the liquid-based technique has gained significant acceptance in recent years. Several independent reports suggest a significant reduction in the rate of unsatisfactory specimens when using the liquid-based technique compared with the conventional one. In January 2004, the Henry Ford Health System implemented an institutional policy of liquid-based cytological screening. By August of that year the policy was fully operational in all HFHS clinics and hospitals. We report the primary findings of an ongoing cost-effective analysis study of this policy.

Design: We have implemented a cost-effectiveness study with the objective of comparing the outcome of converting cytological screening from the conventional methods to the liquid-based technique. The outcome is measured in terms of monetary cost per unit of effectiveness. We have defined the monetary cost as the ratio of expenses observed by the laboratory to the charges directed to the patient per month. The unit of effectiveness is defined as the proportion of unsatisfactory specimens to the total specimens processed per month. Administrative cytopathology data, beginning with January 1st, 2002 and ending with June 30th, 2006, were retrieved from the Pathology Information System. Statistical analyses were performed using SAS for window version 9.1 (SAS Institute, Cary, NC).

Results: The overall monthly rate of specimen evaluation in the cytopathology laboratory at our institution declined by 17.5% (95% CI 3.2%-75.0%) when the technique was converted to the liquid-based method. However, the overall decline in the monthly rate of unsatisfactory specimens was 58% (95% CI 25.3%-209.7%). The proportion of unsatisfactory specimens (unit of effectiveness) using the liquid-based technique was approximately 2-fold lower than the conventional method ($p < .001$). Findings suggest that monetary cost for the two techniques is not statistically significant; however, the difference in the monetary cost per unit of effectiveness is.

Conclusions: Preliminary results suggest that the liquid-based screening method offers a cost effective screening method despite its higher laboratory direct operational cost. It is emphasized that we did not include the indirect costs, i.e. ancillary staff's time and resources required for rescheduling of a patient for a second visit, the clinician's time and the patient's time and resources in this preliminary analysis.

1573 Using Lean Methods To Reduce Errors, Improve Efficiency, and Reduce Costs in an Anatomic Pathology Lab

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Background: In industry, Lean methods have been shown to improve quality, reduce inefficiency, and decrease costs. Although Lean methods have been applied with some success in the clinical lab, there has been little study of Lean methods in anatomic pathology labs.

Design: We implemented a Lean learning line in the histology component of an anatomic pathology lab. After a 3 year period, we measured the metrics of efficiency (turn around time (TAT)), production to staffing ratio, and errors pre and post implementation. We initiated a tracking system that measured 24 separate quality/error metrics (e.g., loss of tissue, poor quality stain). We performed over 200 documented line "experiments" affecting quality and/or error. Each experiment was scored on a 1 to 5 basis (5 being high) for the mean impact (degree of error reduction), success (sustainability and degree of affect on targeted measure), and complexity (scale of intervention). We estimated the degree of error reduction by performing root cause analysis of errors at each step in the histology process and assessing how each initiative affected these errors. Costs were assessed by measuring Medicare technical fees, based on CPT codes, and distributed across the different technical lab components (e.g., gross room, histology, etc.).

Results: Although the volume of work increased by 73%, the TAT within the histology component decreased by 42%. The production to staffing ratio, as measured by the specimens of work per day divided by the number of workers, increased from 8.2 to 10.3 (increase of 26%), reflecting an increase in productivity. The increased volume resulted in increased revenue of $125,000 per year attributable solely to the histology lab productivity. Prior to implementation, very few errors were reported and error reporting increased by over 3000%, as the culture of the lab changed from one of fear to ownership. The mean impact, success, and complexity of each experiment was 2.4, 2.7, and 2.5, respectively, although 32%, 26%, and 20%, respectively, had scores greater than 4. We estimated that these experiments reduced the frequency of error by approximately 45%. Error reduction initiatives improved specimen quality and interpretability and drastically reduced the probability of specimen switches.

Conclusions: The Lean learning line markedly improved efficiency, decreased errors, improved quality, and decreased costs.

1574 Focused Surgical Case Review of Bone and Soft Tissue Tumors for Quality Assurance

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Background: Inadequate sampling and lack of clinical and radiological information contribute to diagnostic errors of somatic soft tissue and bone tumors. As a part of our departmental quality assurance program, we performed a focused retrospective review of relatively more common soft tissue and bone tumors such as lipomatous tumors of soft tissue and chondroid tumors of bone.

Design: A single experienced bone and soft tissue pathologist (UR) reviewed 61 lipomatous tumors (41 liposarcomas and 20 well differentiated lipoma like liposarcoma /atypical lipomatous tumor (WDLS/ALT)) and 73 chondroid tumors (16 chondrosarcomas, 34 enchondromas, 14 chondromas, and 9 other). The cases of WDLPS/ALT and chondroid tumors had a minimum of 10 and 5 hematoxylin & eosin slides, respectively, for review. Discrepant cases were classified as major or minor variance. Major variance indicated that the original and review diagnoses entailed differences in prognosis and/or treatment.

Results: In WDLPS/ALT cases, the reviewer detected 5 minor discrepancies related to the presence of a higher grade tumor (1case) and the presence of atrophic myofibroblasts and fat necrosis that simulated lipoblast in addition to classic lipoblasts (4 cases). In WDLPS/ALT cases, the reviewer detected 3 discrepancies with major variance with original diagnosis of liposarcoma. (review diagnosis of hibernoma (1case) and large lipomas with spindle cell component (2cases). Inadequate sampling played a role in these errors.On followup, the change in diagnosis did not impact on clinical outcome in these three cases. For chondroid neoplasms, the reviewer detected 5 minor variances related to grade (grade 1 vs grade 2).

Conclusions: We determined an overall discrepancy proportion of 9.7%, and major variance was detected in 2.2% of cases. Minor variance reflected a lack of standardization. We conclude that consensus, expert, or conference review, particularly for WDLPS/ALT cases, would be helpful for error reduction. For chondroid neoplasms of bone, clinical and radiological correlation with histological features continue to be the gold standard for accurate diagnosis.

1575 How Implementaion of the Electronic Medical Record Affected Clinicians' Compliance in Gynecologic Cytology

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Background: Last Menstrual Period (LMP) history, as defined per College of American Pathologists (CYP.03400) is important clinical information that can influence interpretation of a Pap Test, and therefore should be accompany the cytology specimen. The purpose of this study was to evaluate how the implementation of the electronic medical record (EMR) affected the compliance of clinicians in providing this information.

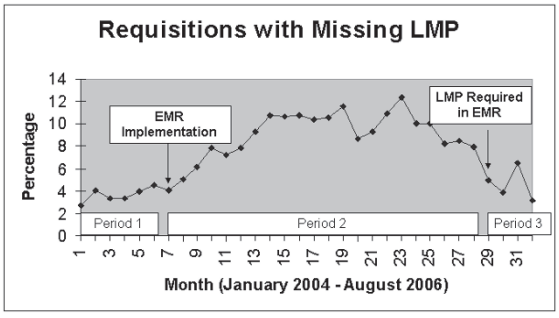
Design: We reviewed cytology requisition deficiencies (missing LMP data), and compared the rates of those deficiencies for 3 periods: 1-proceeding (Jan – Jul 2004), 2-during (Aug 2004 – Apr 2006), and 3-following (May – Aug 2006) EMR implementation. The rates of three diagnostic categories related to glandular lesions: adenocarcinoma, atypical glandular cells - NOS, atypical glandular cells - endometrial type were also reviewed. In addition, the rate of the unsatisfactory diagnosis was evaluated.

Results: Figure 1 demonstrates the change in missing LMP rates by month. Rates of missing LMP were significantly higher during Period 2 (mean=9.2%) when compared to Periods 1 and 3 (means=3.7, 4.5 respectively), *($p<0.0001$, see Table 1)*. There were no significant differences in diagnostic rates of glandular lesions or unsatisfactory specimens, except adenocarcinoma *($p<0.0001$)*.

Conclusions: When possible, clinicians would omit additional data entry, such as the LMP, during the office visit, even when the information was considered critical for the specimen submitted. Implementation of the EMR was initally associated with a significant increase in missing clinical information (LMP) in gynecological cytology specimens, and improved compliance was achieved only after it became a required field in the EMR.

Missing LMP and Diagnoses Rates

	Missing LMP	Adenocarcinoma	Atypical Glandular Cell, NOS	Atypical Glandular Cell Endometrial Type	Total Specimens
Period 1 (Jan-Jul 2004)	447 / 3.7%	9	22	9	12055
Period 2 (Aug 2004-Apr 2006)	3423 / 9.2%	17	76	10	37175
Period 3 (May - Aug 2006)	299 /	5	17	1	6550



1576 Evaluation of the Clinical Efficacy of a 6-Level Step Sectioning Model in the Routine Examination of Cervical Biopsies: A Study of 600 Consecutive Biopsies

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Background: In spite of technological advances in colposcopic techniques, there continues to be a 10-20% discordance rate between colposcopic findings and the histologic diagnoses of the resultant biopsies. One of the many factors to which this may be attributable is related to sampling error from the paraffin-embedded tissue block. In this study, we evaluated the clinical efficacy of routinely obtaining 6 step sections in cervical biopsies, using the frequency with which dysplastic lesions would be missed with various levels of sectioning as the sole benchmark determinant of clinical efficacy.

Design: Our database was searched for all cervical biopsies in which a dysplastic lesion was diagnosed for the period 02/01/06-04/28/06. Six-level step sectioning entails cutting and hematoxylin/eosin-staining 6 consecutive sections from the paraffin block without preserving any intervening unstained sections. The slides were then reviewed by a gynecologic pathologist. The first level at which a dysplastic lesion could be unequivocally diagnosed was determined. Dysplasia grades were also tabulated. Statistical comparisons were carried out with Fisher's Exact and student's t tests, using a $p<0.05$ threshold for significance.

Results: 600 consecutive biopsies from 404 patients were reviewed. For the whole cohort, the average level at which a dysplastic lesion was unequivocally diagnosable was 1.9 (median 1). 357 (59.5%), 97 (16.16%), 41 (6.8%), 55 (9.1%), 34 (5.7%), and 16 (2.7%) of the 600 lesions were diagnosable at levels 1, 2, 3, 4, 5 and 6 respectively. CIN 2/3 (n=89) were on average, diagnosable at an earlier level (1.35) than CIN 1 (n=511): level 2.025 ($p<0.001$). Indeed, 80% of CIN2/3 were diagnosable at Level 1, as compared with 56% of CIN 1 ($p<0.001$). 88,38,52,31 and 16 cases of CIN 1 and 10, 3, 3, 2, 0 of CIN 2/3 cases were diagnosable at Levels 2, 3, 4, 5 and 6 respectively. Therefore, if sectioning were limited to 3 levels, 17.3% (104/600) of all dysplastic lesions would have been missed, including 19% (99/511) of CIN 1 and 5.6% (5/89) of CIN2/3.

Conclusions: Since only 3 levels are routinely evaluated in most laboratories, our findings suggest that sampling error is indeed at least one significant factor contributing to colposcopic/histologic discrepancies. Using our clinical efficacy standard, in the setting of no pathologic findings of a colposcopic-directed biopsy, at least 5 levels (*a priori* or in recuts) are required to ensure 100% and 97.4% diagnostic accuracies for CIN 2/3 and CIN 1 respectively.

1577 Statistical Analysis of Surgical Pathology In-House Peer Consultation in a Large University Hospital Setting

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Background: Improving diagnostic accuracy is an aim for every surgical pathologist in practice. Personal consults, sending out cases for expert opinion, and in-house consensus meetings have been established in most big centers to minimize diagnostic errors and to reach an accurate diagnosis in uncommon cases. Sparse statistical data has been published to help predicting the volume and the range of lack of consensus percentages.

Design: In-house daily consensus conference is held for the signing pathologist who shows difficult cases from the daily general surgical pathology sign out cases (except hematolymphoid cases which are signed out by a hematopathologist in a separate department.) Two hundred forty three cases out of a total of 6847 well mixed surgical pathology cases were brought to the daily consensus conference in the period between January 1st and June 1st of 2006. Cases were categorized based on their location/organs as well as consensus or lack of consensus which would mostly result in sending the case out for an expert opinion.
Results: Lack of consensus was noted in 5/17 neuropathology cases (29%), 5/39 digestive system including liver and salivary glands (12%), 1/10 endocrine system cases (10%), 2/25 female breast cases (8%), 2/39 genitourinary system cases (5%), 2/38 respiratory including mediastinal pathology cases (5%), 1/56 skin and soft tissue cases (1.7%), and 0/19 Gynecologic cases (0%.)
Conclusions: In a six-month period and 6847 surgical pathology cases, the signing pathologist identified 243 difficult cases that were brought to consensus conference for peer opinion. Lack of consensus was observed in 13/234 cases (5 %.) This data sets a reference point, at which, pathologists from large institutions can use it to predict the volume and percentage of cases with lack of consensus as well as the potential send-out volume, if a daily conference is conducted for this purpose.

1578 Comparative Study of Reflex Human Papilloma Virus Status and Clinical Management in Subsets of Atypical Squamous Cells of Undetermined Significance Cytology

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Background: Reflex Human Papilloma Virus (HPV) testing is currently performed on cervical-vaginal cytology samples with cytology diagnosis of Atypical Squamous Cells of Undetermined Significance (ASC-US). Within the ASC-US category there are at least two subsets, including a subset of cases submitted by the cytotechnologist (CT) as ASC-US and another subset of cases submitted as a higher-grade lesion (ASC-H, LSIL, HSIL) and downgraded by the pathologist to ASC-US. It has been proposed that a HPV+ yield rate be utilized to help identify potential underutilization/overutilization of ASC-US diagnosis. The purpose of this study was to determine the impact on subsequent clinical management based on ASC-US subsets.
Design: A total of 1318 cases signed out as ASC-US and reflexed to HPV testing between 1/1/05 and 6/30/05 were included in this study. The HPV test was done using nucleic acid hybridization with signal amplification. The CT diagnoses, HPV test results, and subsequent follow-up results (cytology and/or biopsy) within one year were recorded for each of the cases. The cases that were submitted by CT as ASC-H/LSIL/HSIL were regarded as ASC-US-pullback subset. The cases that were submitted as ASC-US were regarded as ASC-US subset.
Results: The study included four cytopathologists, whose overall ASC-US rate ranged from 26% to 44% ($p<0.0001$) and ASC-US-pullback rates ranged from 22% to 38% ($p<0.0001$). Follow-up rates for all ASC-US by cytopathologists were similar, ranging from 65% to 69%. The HPV+ rate was higher in the ASC-US-pullback subset than that in the ASC-US subset, 44% versus 28% ($p<0.0001$). The two subsets follow-up rates also differed, 81% versus 73% ($p<0.0001$). The follow-up biopsy results of HPV+/ASCUS cases were similar between the two subsets (ASC-US-pullback subset 12% benign, 66% CIN I, 22% CIN II-III; ASC-US subset 16% benign, 66% CIN I, 19% CIN II-III). The follow-up biopsy rate for HPV+/ASC-US cases was higher than that of LSIL cases, based on our historical data (46% versus 34%).
Conclusions: Although there is variation within our practice for diagnosis of ASC-US, there does not appear to be any significant difference in term of clinical patient management. Although the ASC-US-pullback subset had both higher HPV+ rate and follow-up rate, the subsequent biopsy follow-up results were similar between the two subsets, suggesting that the ASC-US-pullback diagnosis is not detrimental to clinical management.

1579 Synoptic Formatting Improves Quality of Cancer Pathology Reports: A Population Based Analysis of 4538 Cases

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Background: Standardized synoptic reporting of cancer pathology facilitates both clinical management and data collection by cancer registries, planning agencies and accrediting bodies. In a population based analysis we studied the relationship between completeness of cancer pathology reports (CPRs) using an international standard and format of reporting.
Design: The Province of Ontario (population - 12.5 million) is composed of 14 Local Health Integration Networks (LHINs). Cancer Care Ontario (CCO) receives approximately 90% of CPRs on a daily basis from hospitals in each LHIN through an automated electronic linkage. In 2005, a random sample of 4538 cancer resection cases (5242 accessions) including prostate (828), colorectal (1431), lung (533) and breast (1746 cases; 2450 accessions) were analyzed to determine whether reports included mandatory reporting elements (MREs) from the College of American Pathologists cancer protocols. Coders under the guidance of expert tumor site panels recorded the presence or absence of MREs along with the report format, synoptic (SYN) or narrative (NAR). SYN reports were defined as ones with concise headings and lists of prognostic elements. The relationship between format and completeness was analyzed at provincial, LHIN and hospital levels. Sampling methods targeted confidence intervals of $\pm$2% at the provincial level and $\pm$10% at the hospital level.
Results: 3811/4538 (84%) of cases were reported synoptically including breast (86.9%), lung (83.7%), colorectal (82.3%) and prostate (81.4%). The relationship between report completeness and format is shown in the table below. The difference in completeness rates between SYN and NAR cases was statistically significant for each tumor site (Chi-square and Fisher exact tests; $p<0.0001$). There was considerable variation at LHIN and hospital levels in completeness of CPRs: prostate 37-100%, lung 24-96%, breast 50-88%, colorectal 25-100%.
Conclusions: Synoptic formatting of CPRs correlates with improved quality as defined by less missing essential information. The variation in completeness of CPRs in Ontario provides an opportunity for quality improvement using knowledge transfer strategies and funding levers.

		No. cases (% Complete Reports)	
Site	No. cases	Synoptic	Narrative
Prostate	828	674 (97%)	154 (50%)
Lung	533	446 (86%)	87 (34%)
Breast	1746	1517 (80%)	229 (43%)
CRC	1431	1178 (78%)	253 (28%)

1580 Histopathologic Properties of Benign Pulmonary Nodules Resected Following Multidetector High Resolution Computed Tomography

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Background: It remains a diagnostic challenge to discriminate between benign and malignant pulmonary nodules, even after radiologic evaluation with multidetector high-resolution computed tomography (CT). Thus, a patient with a benign nodule may undergo an unnecessary surgical procedure. The aim of this study was to evaluate the necessity of nodule resection and to examine the histopathologic properties of benign pulmonary nodules. These properties may be helpful discriminatory features to identify the nature of a pulmonary nodule; especially as technologic advances continue to improve the resolution of CT scans.
Design: We retrospectively reviewed 166 consecutive lung wedge biopsies and resections and identified 18 cases (11%) with an in-house CT chest scan and a subsequently resected benign pulmonary nodule. The clinical history, the radiology report and the H&E sections of these nodules were evaluated.
Results: In the majority of the cases, the patient either had a history of malignancy (11 of 18 nodules, 61%) or the radiology report expressed a concern for malignancy (13 of 18 nodules, 72%). In five cases, despite the strong radiologic impression of an infectious or granulomatous disease, a resection was performed. The diagnoses included the following: 12 granulomas, 4 pleural plaques/post-inflammatory changes and 2 fungal infections. The interface between the nodule and the background tissue was sharply demarcated in 7 cases and was irregular/somewhat infiltrative in 11 cases. Calcification was present in 9 cases and absent in 9 cases. The nodule was very avascular in 9 cases due to hyalinization or fibrosis. 5 nodules elicited a diffuse inflammatory infiltrate throughout the nodule and 3 had a sharp rim of inflammatory cells surrounding the nodule periphery.
Conclusions: Despite a strong radiologic impression of a non-malignant nodule, surgical resections are occurring. This reflects the need for more clear medical guidelines of when resections are not necessary and would clearly be beneficial to both the patients and medical profession. The various histologic features, as listed will increase in utility as discussions between radiologists and pathologists continue and as the resolution of imaging techniques improve.

1581 Clinical Impact of Typographical Errors in Surgical Pathology Reports

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Background: The frequency and clinical impact of typographical errors (TYPO) in surgical pathology are not defined. TYPO errors include mis-spellings, mis-typings or omissions involving both words that actually change diagnoses and non-diagnostic words that do not affect the meaning of the report.
Design: Instances of emendation derived from 5 years of surgical pathology reports, 2001 to 2005, in the surgical pathology laboratory of Henry Ford Hospital were evaluated for root cause. During the first 4 years, the type of error was classified retrospectively. In the last year, a quality coordinator [RCV] prospectively assigned error types as the defects were discovered. Among errors designated as "report defects" over the entire length of the study, a subcategory was designated as "typographical". The defects in the TYPO subgroup that involved diagnoses, as distinct from supporting information in a report, fell into three subcategories. 1- Spelling "slips" changing the diagnostic interpretation,. 2- Spelling "slips" changing words unimportant to diagnostic interpretation, and 3- Lines or words omitted from the diagnostic portion of the report. The distribution of TYPO report defects into these 3 subcategories was analyzed.
Results: Over 5 years 241,216 surgical pathology cases were processed. 113 were amended for TYPO defects, for an overall frequency of 4.7 per 10,000 cases. Before the involvement of the coordinator, the frequency was 2 per 10,000 cases. After process standardization with the coordinator the frequency rose to 9 per 10,000 cases. Among the 113 TYPO errors 27 [24%] involved diagnostic words 78 [69%] non-diagnostic words, and 8 [7%] were omitted or missing diagnoses. In 109 of the 113 cases [96%], review of patient charts allowed outcome documentation. In 108 cases there was no evidence of clinical impact of the TYPO errors. In 1 case the record documented clinician dissatisfaction, but in no case was there evidence of patient harm or injury.
Conclusions: TYPO errors causing emendation of pathology reports are rare, less than 5 per 10,000. Those involving diagnostic words or omission of diagnoses are rarer still: 1 and less than 1 per 10,000. In our hands, standardization of the emendation process and root cause analysis of TYPO defects more than quadrupled the frequency with which this sort of error was detected and documented. This suggests that comparisons of TYPO error among laboratories are strongly influenced by the degree of standardization and thoroughness of analysis of report defects in each laboratory.

1582 Pre-Biopsy PSA and Highest Percentage of Cancer (hPCA) on Prostate Biopsy Can Adequately Predict Upgrading of Gleason Score (GS) on Subsequent Prostatectomy: A Single Institution Study in a Cohort of Patient with GS 6

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Background: Several studies have shown that Gleason Score (GS) is a strong predictor of adverse outcomes after prostatectomy for prostate cancer. Specifically, upgrading of tumors scored as GS=6 on initial biopsy, to a GS>6 on subsequent prostatectomy imposes a significant burden, given the aggressive behavior of cancers with GS>6. The current study was performed to identify demographic and biopsy variables that might predict such upgrading to GS>6 in a cohort of patients with GS=6.

Design: A total of 647 prostate cancer patients diagnosed between 1999-2003 who had concurrent prostatectomy data and biopsy data available were identified in our database. From this, we selected a cohort of 184 patients with a biopsy GS=6. Clinical data including age, pre-biopsy PSA, and biopsy variables including percentage of positive biopsy sites (PPBS), highest percentage of cancer at any single site (hPCA), and presence of high-grade prostatic intra-epithelial neoplasia (HGPIN) or perineural invasion (PNI) were extracted. Multivariate logistic regression models (LRM) using a forward Wald method were constructed in SPSS 13 (Chicago, IL) to identify factors predictive of upgrading to GS>6.

Results: From a total of 184 patients with GS=6, ninety-two cases (92) were upgraded to GS>6. Among the upgraded cases, 90 (97.8%) had upgrading to GS 7, and 1 each (1.1%) had upgrading to GS 8 and GS 9. LRM identified a model with two variables that had a statistically significant ability to predict upgrading, including pre-biopsy PSA (Odds Ratio 8.66; 2.03-37.49, 95% CI) and hPCA (Odds Ratio 1.03, 1.01-1.05, 95% CI). This two-parameter model yielded a predictive accuracy of 62.2%. None of the other variables (age, PPBS, presence of HGPIN or PNI) were included in the final model.

Conclusions: The utilization of PSA and highest percentage of cancer at any single biopsy site will significantly help in decreasing the incidence of upgrading of GS on subsequent prostatectomy in a cohort of patient with GS=6 on the initial biopsy. This information may aid treating physicians in more precise risk stratification of patients with prostate cancer prior to therapeutic interventions.

1583 Quality Assurance in Anatomic Pathology: Correlation of Intraoperative Consultation with Final Diagnosis in 2812 Specimens

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Background: The correlation of intraoperative consultation with the final diagnosis on permanent sections should form an integral part of quality assurance activities in the anatomic pathology lab. Despite this, publications on this topic are uncommon and there are no data from Canadian institutions. We aimed to completely review correlation of intraoperative consultation with final diagnoses over a 1-year period in a large general hospital setting in a major Canadian city.

Design: One pathologist reviewed all surgical pathology cases at Calgary Laboratory Services that had an intraoperative consultation from June 2004-May 2005 to determine the intraoperative diagnosis, final diagnosis, correlation between the two, site of request, pathological process, types of disagreement and reasons for disagreement. The agreement rates were calculated as percent agreement, sensitivity/specificity, positive and negative predictive values, likelihood ratios, Youden J and the kappa statistic with 95% confidence intervals.

Results: 2812 specimens had an intraoperative consultation, of which 109 were discordant and 122 were deferred to permanent sections. The percent agreement was 96.12% (95%CI 95.41, 96.84) with a kappa statistic of 0.92 (95%CI 0.90, 0.93). The other measures of agreement were similarly high. Lymph nodes for metastases (427), thyroid/parathyroid (401) and CNS/PNS (378) specimens were most frequently sent for intraoperative consultation and the latter two tissue types accounted for the greatest number of disagreements. The most common pathological processes encountered were presence/typing of a neoplasm (1093) and assessment of margins (698), both of which accounted for the largest number of disagreements. Disagreements were most frequently due to interpretive (64) and gross sampling errors (33); false negative disagreements were 3 times as common as false positives.

Conclusions: By all measures used, the intraoperative consultation was an excellent diagnostic test. Limited pathological processes encountered in specific groups of specimens produced most of the disagreements. Two categories of error were responsible for the majority of the disagreements, which were most commonly false negatives. These results suggest specific measures that can be taken to reduce the number of discrepancies.

1584 Frozen Sections on Basal Cell Carcinomas: Improving Accuracy of Margin Evaluation and Assessment of Clinical Impact

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Background: Basal cell carcinoma (BCC) is the most common form of skin cancer. While metastatic spread and death from disease are rare, there is morbidity associated with these lesions in the form of local recurrence. Frozen section (FS) examination is often used to evaluate the margins of these tumors when arising in locations where skin-sparing is paramount. Unfortunately, the accuracy of FS is sub-optimal with false negative (FN) rates as high as 15% reported. We studied a cohort of specimens from patients with BCC who had FS examination for margin status, and determined which factors may have contributed to FN FS diagnosis. Additionally, we evaluated the subsequent actions of the surgeons in response to positive margins and recurrence rates.

Design: Between 1/2000 and 10/2000, 181 consective cases of BCC which had FS examination were reviewed. Factors which might impact FS accuracy were evaluated: specimen size, tumor site, pathological subtype, distance from margin, quality of FS slide, % of specimen frozen, and number of FS slides prepared per specimen. In cases with positive margins (either true positive or false negative FS), we documented whether the margin was re-excised . We also documented the presence of tumor recurrence.

Results: The FN rate was 13.3% (n=24). Good FS quality (all margins evaluable, p=0.04) and greater distance from surgical margin on FS (p=0.004) correlated with a lower FN rate. Fewer slides made during FS, smaller specimen size, and greater % of specimen frozen were also associated with lower FN rates, but these were not statistically significant. Patients with FN FS had a higher recurrence rate (RR) than those with accurate FS (29.2% vs 13%,p=0.04). Specimens with positive margins on either FS or permanent section only (FN) were reexcised 57.5% of the time. The RR of reexcised positive margins was not significantly different than those that were not reexcised.

Conclusions: Only close surgical margins and sub-optimal FS quality had a statistically significant relation to FN FS. Error rates in BCC frozen section might be reduced if close margins are considered positive and re-excised and FS quality is enhanced. However, the failure of surgeons to consistently act on positive margins and the inability of reexcision to impact significantly BCC recurrence calls into question the need for FS evaluation.

1585 Mis-Identification Defects in the Analytic Phase of Surgical Pathology Work Processes

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Background: Accuracy of patient identification is a national patient safety goal for laboratories requiring evaluation and monitoring of processes involved in accuracy of patient and sample identification at specimen collection, analysis and resulting (CAP TLC.11100). In surgical pathology (SP), these activities encompass the total test process from pre-analytic (specimen collection, labeling, transport) through analytic (specimen accession, gross, histology, slide interpretation, report generation) to post-analytic (report transmittal, interpretation). The frequency of mis-identification within the SP domain (internal mis-ID defects) is unknown. We defined these defects within the analytic phase of testing , as a prelude to implementing barcode specified work processes in SP.

Design: Internal mis-ID defects were documented over 3 weeks in July 2006 by 59 personnel in the SP laboratory of Henry Ford Hospital. Defects were categorized by part (lab tag, specimen container, block, slide, report) and further by root cause (patient name, label, medical record number, accession, specimen part, slide level and recut numbers, tissue and diagnosis). Defect frequencies and sigma values were calculated for error opportunities (cases, specimen parts, blocks and slides).

Results: From 2694 cases, there were 4413 specimen parts, 8776 blocks and 14,270 slides. 45 (1.67%) cases had mis-ID defects with 10 defects in accessioning, 5 in blocks and 30 in slides. Defect rate per million opportunities was on average 4.4 sigma or 1856 per million. Accessioning defects were due to case number, medical record number, part type, laterality, tissue site and manual block generation. 3 block defects were from specimen grossing and 2 at the microtome. 26 of 30 slide mis-ID defects had incorrect labels and in 4 cases pathologists transposed slide numbers. Internal mis-ID defects resulted in 4 amended reports, 2 of which resulted in changed diagnoses. Defects required 159 hours of rework to correct, equal to an annualized manpower increment of 1.3 full time equivalent employees.

Conclusions: This is the first documentation of frequency and root causes of identification defects occurring within the work processes of SP. All mis-ID defects would have been potentially addressed by use of an integrated identification system of barcoded lab tags, blocks and slides. This defect frequency supports investment in technology to address these potentially critical errors, the cost of which may be offset by avoidance of labor required to correct defects.

Techniques

1586 Rapid Quantitative Measurment of Gene Expression in Formalin-Fixed Tissues and LCM Samples without RNA Purification Using the QuantiGene® Branched-Chain DNA Assay

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Background: The difficulty in measuring RNA concentrations in FFPE tissues arises from extensive fragmentation and crosslinking of RNA after formalin fixation. The QuantiGene® (QG) assay does not require RNA purification and relies on cooperative hybridization: its probe design and non-enzymatic RNA capture and detection overcome the adverse effects of formalin fixation. The QG technology uses an ELISA-type format and is ideally suited for simple, rapid and high-throughput sample preparation and measurement of gene expression panels in FFPE tissue homogenates.

Design: Duplicate samples from 10 different xenografts were snap frozen or fixed in formalin. RNA was measured either after isolation (pRNA) or after solubilization in a tissue homogenization buffer (thRNA). Probe sets for capture of formalin-fixed (FF) RNA were specifically designed for short RNA fragments. To validate the QG assay, we measured the expression of six genes in 20 samples in parallel by qPCR, Agilent 2100 bioanalyzer and QG assay and obtained correlation coefficients directly from the variance components model. To evaluate the reliability of the QG assay, we determined the intraclass correlation coefficient (ICC). Laser capture microdissection (LCM) was performed with the Veritas® instrument.

Results: Measurements using the QG assay for RNA preparations from FF tissues were highly reproducible, with ICCs of six genes ranging between 0.84 and 0.97. The correlation coefficients for measurements of gene expression by QG assay in FF and