Journal Watch – November and December, 2014

Sessile serrated polyps at screening colonoscopy: have they been under diagnosed?

Tinmouth J, Henry P, Hsieh E, Baxter NN, Hilsden RJ, Elizabeth McGregor S, Paszat LF, Ruco A, Saskin R, Schell AJ, Torlakovic EE, Rabeneck L.

Am J Gastroenterol 2014;109(11):1698-704.

http://www.ncbi.nlm.nih.gov/pubmed/25001254

This is a prospective study of 2,527 asymptomatic patients undergoing colonoscopy between 2003 and 2008 with assessment of rates of subsequent colonoscopy, polypectomy, and development of colorectal carcinoma. All hyperplastic polyps greater than 5mm were reviewed in 2011 and 29% of participants had their polyp reclassified as sessile serrated adenoma/polyp. Surveillance guidelines were from the 2012 consensus update by the US Multi-Society Task Force on Colorectal Cancer published in *Gastroenterology*. The study authors found that 48% of participants with high-risk adenomas received appropriate follow-up as compared to 26% of participants with high-risk SSA/Ps. The low rates of guideline adherence was highlighted by the authors.

Epidemiology of goblet cell and microvesicular hyperplastic polyps.

Qazi TM, O'Brien MJ, Farraye FA, Gould RW, Chen CA, Schroy Iii PC.

Am J Gastroenterol 2014;109(12):1922-32.

http://www.ncbi.nlm.nih.gov/pubmed/25350766

This study was a secondary analysis of a cross-sectional survey of 3,395 adults aged 50-79 undergoing screening colonoscopy with the aim of identifying epidemiological risk factors for developing hyperplastic polyps, both microvesicular type (BRAF V600E) and goblet cell type (KRAS-mut). A total of 5.3% of subjects had MVHPs and 8.7% had GCHPs. An increased risk of both types of HP was found to be independently associated with a history of smoking greater than 20 years, and BMI>30 was associated with MVHPs. African American and Asian subjects were less likely to have MVHPs. African Americans did have an increased risk of GCHPs. The authors note that they performed a similar statistical analysis for adenomatous polyps, and found independent factors of increased risk to be increasing age, male sex, and smoking, while NSAID use was associated with decreased risk. This was the first study to identify epidemiologic risk factors for the development of hyperplastic polyps.

Prognostic relevance of estrogen receptor-α Ser167 phosphorylation in stage II-III colon cancer patients.

López-Calderero I, Carnero A, Astudillo A, Palacios J, Chaves M, Benavent M, Limón ML, Garcia-Carbonero R.

Hum Pathol 2014; 45(12):2437-46.

http://www.ncbi.nlm.nih.gov/pubmed/25283475

This is a retrospective study of 218 patients with stage II-III colon cancer who underwent resection. The authors assessed the role of ERalpha, specifically ERalpha phosphorylated at Ser167 (pSer167-ERalpha) which causes upregulated ERalpha activity, on survival and association with clinicopathologic features. IHC for pSer167-ERalpha was performed on a TMA and was scored independently by two pathologists who were blinded to clinical outcome. High expression was seen in females, older patients, and patients with high glucose levels, and was associated with decreased overall survival and 5 year disease free interval. The authors also found on multivariate analysis that the IHC score for pSer167-ERalpha was a significant independent prognostic factor for both overall survival and 5 year disease free interval. The authors conclude that ERs are important in colon cancer biology and anti-ER therapies should be considered.

Colon and endometrial cancers with mismatch repair deficiency can arise from somatic, rather than germline, mutations.

Haraldsdottir S, Hampel H, Tomsic J, Frankel WL, Pearlman R, de la Chapelle A, Pritchard CC.

Gastroenterology 2014; 147(6):1308-1316.e1.

http://www.ncbi.nlm.nih.gov/pubmed/25194673

The aim of this study was to identify acquired somatic mutations in MMR genes in colorectal or endometrial cancer patients whose tumors were found to have MMR deficiency (either by MSI-H and/or absent MMR staining by IHC), but who did not have germline MMR mutations (i.e. Lynch Syndrome). Eligible patients were identified from an ongoing state-wide prospective Lynch syndrome screening study in Ohio (OCCPI) as well as from the previously published Columbus Lynch syndrome study. Next generation sequencing was performed on blood and tumor samples. Almost 70% of patients with MMR deficiency without germline MMR mutations were found to have acquired somatic

MMR gene mutations (the hypermutated pathway). A few patients were found to have false-positive initial (screening) MMR-deficiency results. The authors conclude that tumor DNA sequencing is helpful in this patient population as it reduces the need for intensive cancer screening surveillance and genetic counseling.

Extra-ampullary duodenal adenocarcinoma.

Ushiku T, Arnason T, Fukayama M, Lauwers GY.

Am J Surg Pathol 2014;38:1484-93.

http://www.ncbi.nlm.nih.gov/pubmed/25310836

This retrospective study evaluated 38 extra-ampullary duodenal adenocarcinomas and showed that there are two major subtypes: intestinal and gastric. Intestinal-type tumors can arise anywhere along the length of the duodenum and often are associated with intestinal-type dysplasia. Gastric-type adenocarcinomas are characterized by a more proximal location, are associated with gastric-type dysplasia, and frequently have adjacent gastric foveolar metaplasia and Brunner gland hyperplasia. The intestinal-type tumors appear to be more favorable and are associated with a longer survival.

Colesevelam and colestipol, novel medication resins in the gastrointestinal tract.

Arnold MA, Swanson BJ, Crowder CD, Frankel WL, Lam-Himlin D, Singhi AD, Stanich PP, Arnold CA.

Am J Surg Pathol 2014; 38(11):1530-7.

http://www.ncbi.nlm.nih.gov/pubmed/24921636

The morphologic features of the bile acid sequestrants (BAS) colesevelam and colestipol, as well cholestyramine, in biopsy specimens are detailed in this study (26 specimens from 15 patients). Sites of involvement included the esophagus (1/26), stomach (1/26), small intestine (1/26), ileocecal valve (1/26), and colorectum (22/26). Concurrent associated histologic diagnoses included normal (8/26), chronic mucosal injury (11/26), acute inflammation (9/26), erosion/ulceration (6/26), and cytomegalovirus (2/26). The BAS resins were histologically indistinguishable from each other; they were all eosinophilic on hematoxylin and eosin (H&E) and lacked internal “fish-scales.” Rare, irregular “fracture” lines presented diagnostic pitfalls by mimicking the true “fish-scales” of Kayexalate and sevelamer. Clues to the correct identification of BAS include recognition that the “fracture” lines were subtle, irregular, and restricted to large fragments or thick sections, likely representing a processing artifact. BAS resins are pale yellow with the AFB stain. Kayexalate is violet on H&E and black with the AFB stain. Sevelamer characteristically displays a 2-toned coloration on H&E and is magenta with the AFB stain. An association with mucosal inflammatory injury was seen (15/26). The authors conclude

that the BAS are innocent bystanders in complicated patients, although their ability to cause mucosal injury in specific settings cannot be excluded.

Gastric high-grade dysplasia can be associated with submucosal invasion: evaluation of its prevalence in a series of 121 endoscopically resected specimens.

Sakurai U, Lauwers GY, Vieth M, Sawabe M, Arai T, Yoshida T, Aida J, Takubo K.

Am J Surg Pathol 2014; 38(11):1545-50.

http://www.ncbi.nlm.nih.gov/pubmed/25310837

The prevalence of submucosal and lymphovascular invasion in a series of 125 endoscopically resected gastric neoplasms was evaluated. On the basis of Western criteria, the lesions were classified as poorly cohesive carcinomas (n = 4) (excluded from further analysis), low-grade dysplasia (n= 4), pure HGD (n = 78), HGD with tubular adenocarcinoma (n = 4), and pure tubular adenocarcinoma (n= 35). Submucosal invasion was found in 3.8% of the 78 HGDs, 75.0% of the 4 HGDs combined with adenocarcinoma, and 11.4% of the 35 adenocarcinomas. Venous invasion was detected in 1.3% of the 78 HGDs, 75% of the 4 HGDs combined with adenocarcinoma, and none of the 35 tubular adenocarcinomas. Lymphatic invasion was absent in HGD but noted in 25% of the HGDs combined with adenocarcinoma, and 2.9% of the tubular adenocarcinomas. The authors conclude that there is a need for HGD criteria refinement, and combined efforts by Japanese and Western pathologists are needed to reach a consensus about appropriate terminology and neoplasia reporting worldwide. The authors further conclude that in a subset of cases, there is a significant difference in the expected risk for submucosal, blood vessel, and lymphatic invasion when cases are evaluated using the Western and Japanese criteria. Better correlation could be achieved without automatically equating Western HGD with Japanese carcinoma, as in many instances there is a perfect correlation between the biopsy findings and the final diagnosis. However, the use of expanded architectural criteria should be considered when diagnosing HGD or tubular adenocarcinoma, to facilitate better and more precise diagnoses, and thus more optimally planned therapy.

Assessment of tumor regression of esophageal adenocarcinomas after neoadjuvant chemotherapy.

Karamintopoulou E, Thies S, Zlobec I, Ott K, Feith M, Slota-Huspenina J, Lordick F, Becker K, Langer R.

Am J Surg Pathol 2014; 38(11):1551-6.

http://www.ncbi.nlm.nih.gov/pubmed/25140894

Pathologic determination of tumor regression provides important prognostic information for locally advanced gastroesophageal (GE) carcinomas after neoadjuvant treatment. Currently there is no common standard for reporting tumor regression in GE cancers. The authors compared the application of 2 major systems for assessment of tumor regression using H&E-stained slides from 89 resection specimens of esophageal adenocarcinomas following neoadjuvant chemotherapy. The slides were independently reviewed by 3 pathologists from different institutions. Tumor regression was determined by the 5-tiered Mandard system (fibrosis/tumor relation) and the 4-tiered Becker system (residual tumor in %). The authors concluded that both systems provide substantial to excellent interobserver agreement for estimation of tumor regression. A simple 3-tiered system with the estimation of residual tumor in % (complete regression/1% to 50% residual tumor/>50% residual tumor) maintains the highest reproducibility and prognostic value.

Upper tract juvenile polyps in juvenile polyposis patients: dysplasia and malignancy are associated with foveolar, intestinal, and pyloric differentiation.

Ma C, Giardiello FM, Montgomery EA.

Am J Surg Pathol 2014; 38(12):1618-26.

http://www.ncbi.nlm.nih.gov/pubmed/25390638

The upper GI endoscopy findings and corresponding biopsies in JPS patients documented in the authors' Polyposis Registry were reviewed. A total of 199 upper gastrointestinal biopsies from 69 endoscopies were available in 22 of 41 (54%) JPS patients. Thirteen of the 22 patients (59%) had >1 gastric JP; 5 also had 6 small bowel JPs. Gastric JPs were identified as early as age 7 in a patient with an SMAD4 gene mutation. Two patients (9%) had high-grade dysplasia in gastric JPs. Invasive adenocarcinoma was diagnosed in the gastrectomy specimen of 1 patient. Five patients had very large gastric polyp burdens and 3 of them underwent total gastrectomy. Three patients died of complications associated with extensive upper JPs. Histologically, 8 of the 56 (14%) gastric JPs identified exhibited dysplasia. All of the 8 polyps demonstrated intestinalized and pyloric gland differentiation intermixed with foveolar epithelium. Dysplasia was seen arising in all 3 types of epithelium. The flat gastric mucosa in 11 patients was unremarkable, without inflammation or intestinal metaplasia. The 6 small bowel JPs exhibited no dysplasia. The authors conclude that the significant incidence of malignancy in syndromic gastric JPs indicates that current screening procedures are insufficient and that removal of precursor lesions is necessary to prevent progression to carcinoma.

Features of gastric and colonic mucosa in congenital enteropathies: a study of histology and immunohistochemistry

Treetipsatit J, Hazard FK.

Am J Surg Pathol 2014; 38(12):1697-706.

http://www.ncbi.nlm.nih.gov/pubmed/25007148

Congenital enteropathies are rare and commonly diagnosed based on identification of the characteristic histologic and/or ultrastructural features in small intestinal mucosa. Here the authors describe the gastric and colonic histologic and immunohistochemical (IHC) staining patterns of tufting enteropathy, microvillous inclusion disease, and enteroendocrine cell dysgenesis. The authors conclude that the characteristic histologic and IHC features associated with the small intestine can be confirmed within the gastric and/or colonic mucosa by careful histologic examination and immunohistochemistry.

Neoplasms arising in large gastric hyperplastic polyps: endoscopic and pathologic features.

Ahn Jy, Son DH, Choi DK, Roh J, Lim H, Choi KS, Lee JH, Kim DH, Song HJ, Lee GH, Jun HY, Kim JH, H S, Park YS.

Gastrointest Endosc 2014; 80(6):1005-1013.e2.

http://www.ncbi.nlm.nih.gov/pubmed/24929480

There is no standard indication for endoscopic removal of gastric hyperplastic polyps (HPs). Although one study suggested that gastric HPs >2 cm be removed, there have been reports of associated malignancy in HPs <2 cm. This retrospective, case-control study conducted at a tertiary-care center included 809 HPs >1 cm. The smallest carcinoma harboring HP in the study was 10 mm in diameter, although the median size was 25 mm (range 10-35 mm). Endoscopic forceps biopsy was most commonly used to diagnose neoplasms in gastric polyps. However, the authors conclude that this method may be insufficient for detecting neoplasms in large HPs because, except for the neoplasm itself, there were no differences in pathologic findings between neoplasm-harboring and control HPs. In addition, neoplastic areas occupied less than one-third of the polyp in 13 of the 30 (43.3%) neoplasm-harboring HPs. Although the authors attempted to evaluate the usefulness of immunohistochemistry in evaluating forceps biopsy samples, the loss of p16 expression and increased Ki-67 labeling occurred only in the neoplastic areas of the HPs, making them unsuitable markers for detecting neoplasm-harboring HPs. Therefore, overall, the authors conclude that HPs >1 cm should be considered for complete endoscopic resection.

Addressing unmet clinical needs: FISHing for bile duct cancer.

Gores GJ.

Cancer Cytopathol 2014; 122(11):789-90.

http://www.ncbi.nlm.nih.gov/pubmed/25273826

This article reviews the clinical utility of a commercial kit for the assessment of biliary tract strictures. The author concludes that correctly managing biliary strictures is difficult and requires the use of a constellation of findings which include the clinical context, cross-sectional imaging studies, and serum tumor markers. Conventional cytology (bile duct brushings) often lacks sensitivity and specificity in this setting. FISH cytologic analysis greatly aids the clinician in making diagnostic and management decisions. The author considers biliary FISH studies to be essential for his practice.

Cell lineage distribution atlas of the human stomach reveals heterogeneous gland populations in the gastric antrum.

Choi E, Roland JT, Barlow BJ, O'Neal R, Rich AE, Nam KT, Shi C, Goldenring JR.

Gut 2014; 63: 1711-20.

http://www.ncbi.nlm.nih.gov/pubmed/24488499

This study reports a thorough geographic mapping of cell types in gastric mucosa via immunohistochemistry and microarray analysis on whole stomach specimens. New findings include: enteroendocrine cells are regionally concentrated (for example, somatostatin secreting cells are concentrated in the proximal stomach), and the antral mucosa contains three types of glands (oxyntic, antral, and mixed-type).

The stem cell organisation, and the proliferative and gene expression profile of Barrett's epithelium, replicates pyloric-type gastric glands.

Lavery DL, Nicholson AM, Poulsom R, Jeffery R, Hussain A, Gay LJ, Jankowski JA, Zeki SS, Barr H, Harrison R, Going J, Kadirkamanathan S, Davis P, Underwood T, Novelli MR, Rodriguez–Justo M, Shepherd N, Jansen M, Wright NA, McDonald SAC.

Gut 2014; 63:1854-63.

http://www.ncbi.nlm.nih.gov/pubmed/24550372

The Barrett gland phenotype was evaluated by means of Ki-67, IdU labeling and expression of MUC proteins, TFF peptides, and LGR5 mRNA, as well as mtDNA mutation and mucin staining. The profile of Barrett glands is similar to that of pyloric glands, with stem cell zone located in the neck of Barrett's glands. Barrett's gland organization is maintained in dysplasia. The authors discuss the concept of "intestinal metaplasia" in light of these findings, and revisit the concept of Barrett segments developing from upward progression of columnar mucosa.

Pathological prognostic factors in locally advanced rectal carcinoma after neoadjuvant radiochemotherapy: analysis of 113 cases.

Sannier A, Lefèvre JH, Panis Y, Cazals-Hatem D, Bedossa P, Guedj N.

Histopathol 2014; 65:623-30.

http://www.ncbi.nlm.nih.gov/pubmed/24701980

This study evaluated prognostic factors in surgical specimens of locally advanced mid-rectal or low rectal cancer after neoadjuvant therapy in 113 patients. The presence of calcifications in the tumor bed was identified as an independent prognostic factor (P = 0.0417 in multivariate analysis). The mere presence of tumor budding was prognostically useful (P=0.3045 in multivariate analysis, but described as strongly associated with local recurrence in univariate analysis, detailed data not presented). No standard was presented on how to measure and report tumor budding, so reporting presence/absence would simplify matters. The authors also reported that ypT stage was a better predictor of outcome (P=0.8007 for ypT0-2 versus ypT3-4 in multivariate analysis, P = 0.003 for ypT0 versus other ypT stages) than tumor regression grade, the latter again not standardized in its reporting.

A combination of nuclear β-catenin and atypical scores as useful diagnostic markers for borderline malignancy of gastric tumours.

Takahashi H, Ohkuma T, Tsuruta T, Saegusa M.

Histopathol 2014; 65:828-38.

http://www.ncbi.nlm.nih.gov/pubmed/25047762

This study included 25 adenomas and 111 gastric carcinomas obtained from forceps biopsy and endoscopic submucosal dissection specimens. Analysis revealed that a combination of nuclear beta-catenin staining and scoring of atypia (nuclear and branching parameters) could aid in the diagnosis of carcinoma. Nuclear beta-catenin staining in a "small cluster pattern" colocalized with positivity for aldehyde dehydrogenase 1 (ALDH1), a cancer stem cell marker.

Applications and advancements in the use of high-resolution microendoscopy for detection of gastrointestinal neoplasia.

Louie, Justin S, Richards-Kortum R, Anandasabapathy S.

Clin Gastroenterol Hepatol 2014; 12(11):1789-92.

http://www.ncbi.nlm.nih.gov/pubmed/25108219

This review article discusses the use of microendoscopy, a relatively new endoscopic tool for interrogating gastrointestinal mucosa. The resolution of this new technology is reported to be under 5 microns. Limitations include the extensive training necessary to interpret the images, the lack of color images, and the severely limited field of view, making it quite time consuming to investigate large mucosal abnormalities. Nevertheless, there have been several reports on the utility of this technology in the identification of Barrett dysplasia, esophageal squamous dysplasia, and colorectal and anal neoplasms.

Complete endoscopic mucosal resection is effective and durable treatment for Barrett's-associated neoplasia.

Vani J.A. Konda, Mariano Gonzalez Haba Ruiz, Ann Koons, John Hart, Shu–Yuan Xiao, Uzma D. Siddiqui, Mark K. Ferguson, Mitchell Posner, Marco G. Patti, Irving Waxman

Clin Gastroenterol Hepatol 2014;12(12):2002-10.

http://www.ncbi.nlm.nih.gov/pubmed/24732285

This study reports the use of complete endoscopic mucosal resection of all Barrett mucosa in patients with biopsy proven high grade dysplasia and intramucosal adenocarcinoma (rather than the more widely utilized technique of targeted EMR for dysplastic lesions and early adenocarcinomas). This technique, while often requiring several endoscopic sessions, resulted in durable complete eradication of any Barrett's mucosa in 72% and neoplasia in 100% of the 80 treated patients. The primary adverse event reported was esophageal stricture formation, which was amenable to endoscopic dilatation.

Measuring stem cell dynamics in the human colon – where there's a wiggle, there's a way.

Leedham SJ.

J Pathol 2014; 234:292-5.

http://www.ncbi.nlm.nih.gov/pubmed/25112223

This invited commentary discusses stem cell biology in the colonic crypt as revealed by somatic mutations in mitochondrial DNA, which allow tracking and mapping of progeny cells. This technique allows for investigation of stem cell dynamics in human colonic mucosa.

Gastric neuroendocrine neoplasms and related precursor lesions

La Rosa S, Vanoli A.

http://www.ncbi.nlm.nih.gov/pubmed/25053544

J Clin Pathol 2014; 67:938-48.

This review article discusses the diagnostic histologic features of gastric neuroendocrine neoplasms. The pathogenesis of the various tumor types are also presented and an integrative approach to classification is presented.

Clinicopathologic and molecular analysis of disseminated appendiceal mucinous neoplasms: identification of factors predicting survival and proposed criteria for a three-tiered assessment of tumor grade

Davison JM, Choudry HA, Pingpank JF, Ahrendt SA, Holtzman MP, Zureikat AH, Zeh HJ, Ramalingam L, Zhu B, Nikiforova M, Bartlett DL, Pai RK.

Modern Pathol 2014; 27: 1521-39.

http://www.ncbi.nlm.nih.gov/pubmed/24633196

This study attempts to refine the grading criteria for mucinous appendiceal neoplasms. The current WHO classification proposes a two tiered grading system, low and high grade, while the current AJCC staging manual (7^{th} edition) essentially proposes a three-tiered system in which low grade tumors are designated as G1 and high grade tumors are stratified into grades G2 and G3. While the three tiered system may convey more information when reporting, the AJCC does not explicitly propose clear criteria for stratification. To evaluate the utility and refine the criteria of a three tiered system, 219 cases from 151 patients were evaluated by morphologic features and complimentary molecular testing for loss of heterozygosity. On univariate analysis, features associated with a worse overall survival were as follows: destructive invasion, high cytologic grade, high tumor cellularity, angiolymphatic invasion, perineural invasion, and signet ring cell component. On the basis of these features tumors where then stratified into three grades: G1 with no adverse histologic features; G2 with at least one

adverse component other than signet ring cells; and G3 with a signet ring cell component. On multivariate analysis this grading system was found to be a significant predictor of outcome.

Tumor budding is associated with an increased risk of lymph node metastasis and poor prognosis in superficial esophageal adenocarcinoma

Landau MS, Hastings SM, Foxwell TJ, Luketich JD, Nason KS, Davison JM.

Modern Pathology 2014; 27: 1578-89.

http://www.ncbi.nlm.nih.gov/pubmed/24762549

The purpose of this retrospective study was to evaluate the prevalence, extent of, and predictive value (while controlling for other risk factors) of tumor budding for the risk of lymph node metastasis in superficial (pT1) tumors. A total of 210 surgical resections of pT1 tumors were evaluated. "Tumor buds" were defined as a cluster of fewer than five cells at the invasive front of the tumor and a "tumor budding field" was defined as a 20x field with more than five buds. The final tumor bud score was taken from the section (block) with tumor that had the greatest number of fields. The cases were stratified into three groups: no budding fields, 1 to 2 budding fields, and greater than 3 budding fields. The authors found that, after controlling for other risk factors, extensive tumor budding was associated with a higher risk of lymph node metastasis and they suggest that tumor budding should be evaluated in superficial esophageal adenocarcinoma.

Approach to the Management of Portal Hypertensive Gastropathy and Gastric Antral Vascular Ectasia.

Qureshi K, Al-Osaimi AM

Gastroenterol Clin North Am. 2014; 43(4):835-47.

http://www.ncbi.nlm.nih.gov/pubmed/25440929

This clinical review article discusses the diagnosis and management of two causes of upper gastrointestinal bleeding that, although usually distinct clinically and by endoscopic appearance, can cause diagnostic difficulties in some cases that biopsy findings can help resolve. Gastric antral vascular ectasia (GAVE) usually occurs in elderly women, is associated with chronic diseases (including chronic renal failure, autoimmune disease, systemic sclerosis, cardiac disease, and bone marrow transplant), and has a characteristic endoscopic appearance of an antral predominant "watermelon stomach". Portal hypertensive gastropathy (PHG), on the other hand, occurs in patients with portal hypertension most often due to cirrhosis and has a characteristic "snake skin" (mosaic) endoscopic appearance in the fundus and upper body of the stomach. Diagnostic difficulty arises in cirrhotic patients with another endoscopic appearance, a "diffuse" or "nodular" pattern of red spots, that can be seen in both GAVE and PHG. The diagnostic distinction is important because treatment for PHG, such as beta-blockers or TIPS, is not effective for GAVE and some treatments for GAVE, such as endoscopic band ligation, may worsen PHG.

Journals Reviewed (November and December, 2014 Issues)

Histopathology

Archives of Pathology and Lab Medicine

Modern Pathology

American Journal of Clinical Pathology

Journal of Pathology

Journal of Clinical Pathology

American Journal of Pathology

Human Pathology

Cancer Cytopathology

American Journal of Surgical Pathology

Advances in Anatomic Pathology

Journal of Molecular Diagnostics

Gastrointestinal Endoscopy

Gastroenterology Clinics of North America

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