Protocol for the Examination of Excisional Biopsy Specimens From Patients With Primary Carcinoma of the Colon and Rectum

Version: Colon and Rectum Biopsy 4.0.2.0  Protocol Posting Date: August 2019

Accreditation Requirements
The use of this protocol is recommended for clinical care purposes but is not required for accreditation purposes.

This protocol may be used for the following procedures AND tumor types:

<table>
<thead>
<tr>
<th>Procedure</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Excisional biopsy</td>
<td>Excisional Biopsy (Polypectomy)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Tumor Type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carcinoma</td>
<td>Invasive carcinomas including small cell and large cell (poorly differentiated) neuroendocrine carcinoma</td>
</tr>
</tbody>
</table>

The following should NOT be reported using this protocol:

<table>
<thead>
<tr>
<th>Procedure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Forceps biopsy</td>
</tr>
<tr>
<td>Local excision (transanal disk excision) (consider the Colon Resection protocol)</td>
</tr>
<tr>
<td>Resection (consider the Colon Resection protocol)</td>
</tr>
<tr>
<td>Cytologic specimens</td>
</tr>
</tbody>
</table>

The following tumor types should NOT be reported using this protocol:

<table>
<thead>
<tr>
<th>Tumor Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Well-differentiated neuroendocrine tumors (consider the Colorectal NET protocol)</td>
</tr>
<tr>
<td>Lymphoma (consider the Hodgkin or non-Hodgkin Lymphoma protocol)</td>
</tr>
<tr>
<td>Sarcoma (consider the Soft Tissue protocol)</td>
</tr>
</tbody>
</table>

Authors
Lawrence J. Burgart, MD*, Sanjay Kakar, MD*; Chanjuan Shi MD, PhD*; Mariana E. Berho, MD, PhD; David K. Driman, MBchB; Patrick Fitzgibbons, MD; Wendy L. Frankel, MD; Kalisha A. Hill, MD, MBA; John Jessup, MD; Alyssa M. Krasinskas, MD; Mary K Washington, MD, PhD

With guidance from the CAP Cancer and CAP Pathology Electronic Reporting Committees.

* Denotes primary author. All other contributing authors are listed alphabetically.

Summary of Changes
Version 4.0.2.0
The following data elements were modified:
Separate Biopsy and Resection into separate documents
Surgical Pathology Cancer Case Summary

Protocol posting date: August 2019

COLON AND RECTUM: Excisional Biopsy (Polypectomy)

Note: This case summary is recommended for reporting excisional biopsy specimens, but is not required for accreditation purposes. Core data elements are bolded to help identify routinely reported elements.

Select a single response unless otherwise indicated.

Tumor Site (Note A)

___ Cecum
___ Ileocecal valve
___ Right (ascending) colon
___ Hepatic flexure
___ Transverse colon
___ Splenic flexure
___ Left (descending) colon
___ Sigmoid colon
___ Rectosigmoid
___ Rectum
___ Other (specify): ________________________
___ Not specified

Specimen Integrity

___ Intact
___ Fragmented

Polyp Size

Greatest dimension (centimeters): ___ cm
Additional dimensions (centimeters): ___ x ___ cm
___ Cannot be determined (explain): _______________________________

Polyp Configuration

___ Pedunculated with stalk
   Stalk length (centimeters): ___ cm
___ Sessile

Size of Invasive Carcinoma

Greatest dimension (centimeters): ___ cm
Additional dimensions (centimeters): ___ x ___ cm
___ Cannot be determined (explain): _______________________________

Histologic Type (select all that apply) (Note B)

___ Adenocarcinoma
___ Mucinous adenocarcinoma
___ Signet-ring cell carcinoma
___ Medullary carcinoma
___ Micropapillary carcinoma
___ Serrated adenocarcinoma
___ Large cell neuroendocrine carcinoma
___ Small cell neuroendocrine carcinoma
___ Neuroendocrine carcinoma (poorly differentiated)##
___ Squamous cell carcinoma

The routinely reported core data elements are bolded.
___ Adenosquamous carcinoma
___ Spindle cell carcinoma
___ Mixed adenoneuroendocrine carcinoma
___ Undifferentiated carcinoma
___ Other histologic type not listed (specify): ________________________________________
___ Carcinoma, type cannot be determined

*Note: Select this option only if large cell or small cell cannot be determined

Histologic Grade (Note C)
___ G1: Well differentiated
___ G2: Moderately differentiated
___ G3: Poorly differentiated
___ G4: Undifferentiated
___ Other (specify): ________________________________________
___ GX: Cannot be assessed
___ Not applicable

Tumor Extension (Note D)
___ Tumor invades lamina propria
___ Tumor invades muscularis mucosae
___ Tumor invades submucosa
___ Tumor invades muscularis propria
___ Cannot be assessed

Margins (select all that apply)

Deep Margin (Stalk Margin)
___ Cannot be assessed
___ Uninvolved by invasive carcinoma
___ Involved by invasive carcinoma

Distance of invasive carcinoma from margin (millimeters or centimeters): ___ mm or ___ cm

Mucosal Margin (required only if applicable)
___ Cannot be assessed
___ Uninvolved by invasive carcinoma
___ Involved by invasive carcinoma
___ Involved by adenoma

Lymphovascular Invasion (select all that apply) (Notes D and E)
___ Not identified
___ Present
___ Small vessel lymphovascular invasion
___ Large vessel (venous) invasion
___ Cannot be determined

Tumor Budding (Note F)
___ Number of tumor buds in 1 “hotspot” field (specify total number in area=0.785 mm²): ___________
___ Low score (0-4)
___ Intermediate score (5-9)
___ High score (10 or more)
___ Cannot be determined
Type of Polyp in Which Invasive Carcinoma Arose (Note G)
___ Tubular adenoma
___ Villous adenoma
___ Tubulovillous adenoma
___ Traditional serrated adenoma
___ Sessile serrated adenoma/sessile serrated polyp
___ Hamartomatous polyp
___ Other (specify): ________________________________

Additional Pathologic Findings (select all that apply)
___ None identified
___ Ulcerative colitis
___ Crohn disease
___ Other polyps (type[s]): ___________________________
___ Other (specify): ___________________________

Ancillary Studies (Note N)

Note: For reporting molecular testing and immunohistochemistry for mismatch repair proteins, and for other cancer biomarker testing results, the CAP Colorectal Biomarker Template should be used. Pending biomarker studies should be listed in the Comments section of this report.

Comment(s)
Explanatory Notes

A. Anatomic Sites
The protocol applies to all carcinomas arising in the colon and rectum. It excludes carcinomas of the vermiform appendix and well-differentiated neuroendocrine tumors.

The colon is divided as shown in Figure 1. The right colon is subdivided into the cecum and the ascending colon. The left colon is subdivided into the descending colon and sigmoid colon (see Table 1).

![Anatomic subsites of the colon](image)

**Figure 1.** Anatomic subsites of the colon. Used with permission of the American Joint Committee on Cancer (AJCC), Chicago, Ill. The original source for this material is the *AJCC Cancer Staging Atlas* (2006) edited by Greene et al and published by Springer Science and Business Media, LLC, www.springerlink.com.

**Table 1. Anatomic Subsites of the Colon and Rectum**

<table>
<thead>
<tr>
<th>Site</th>
<th>Relationship to Peritoneum (see Note J)</th>
<th>Dimensions (approximate)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cecum</td>
<td>Entirely covered by peritoneum</td>
<td>6 x 9 cm</td>
</tr>
<tr>
<td>Ascending colon</td>
<td>Retroperitoneal; posterior surface lacks peritoneal covering; lateral and anterior surfaces covered by visceral peritoneum (serosa)</td>
<td>15-20 cm long</td>
</tr>
<tr>
<td>Transverse colon</td>
<td>Intraperitoneal; has mesentery</td>
<td>Variable</td>
</tr>
<tr>
<td>Descending colon</td>
<td>Retroperitoneal; posterior surface lacks peritoneal covering; lateral and anterior surfaces covered by visceral peritoneum (serosa)</td>
<td>10-15 cm long</td>
</tr>
<tr>
<td>Sigmoid colon</td>
<td>Intraperitoneal; has mesentery</td>
<td>Variable</td>
</tr>
<tr>
<td>Rectum</td>
<td>Upper third covered by peritoneum on anterior and lateral surfaces; middle third covered by peritoneum only on anterior surface; lower third has no peritoneal covering</td>
<td>12 cm long</td>
</tr>
</tbody>
</table>

The transition from sigmoid to rectum is marked by the fusion of the tenia coli of the sigmoid to form the circumferential longitudinal muscle of the rectal wall approximately 12 to 15 cm from the dentate line. The rectum is defined clinically as the distal large intestine commencing opposite the sacral promontory and ending at the anorectal ring, which corresponds to the proximal border of the puborectalis muscle palpable on digital rectal examination (Figure 2). When measuring below with a rigid sigmoidoscope, it extends 16 cm from the anal verge.
Tumors located at the border between two subsites of the colon (e.g., cecum and ascending colon) are registered as tumors of the subsite that is more involved. If two subsites are involved to the same extent, the tumor is classified as an "overlapping" lesion.

A tumor is classified as rectal if its inferior margin lies less than 16 cm from the anal verge or if any part of the tumor is located at least partly within the supply of the superior rectal artery. The rectum commences at the sacral promontory, and the junction of sigmoid colon and rectum is anatomically marked by fusion of tenia coli to form the circumferential longitudinal muscle of the rectal wall. Intraoperatively, the rectosigmoid junction corresponds to the sacral promontory. A tumor is classified as rectosigmoid when differentiation between rectum and sigmoid according to the previously mentioned guidelines is not possible.

References
B. Histologic Types

For consistency in reporting, the histologic classification proposed by the World Health Organization (WHO) is recommended and is shown below.¹

**WHO Classification of Colorectal Carcinoma**

**Adenocarcinoma**
- Mucinous (colloid) adenocarcinoma (greater than 50% mucin)
- Signet-ring cell carcinoma (greater than 50% signet-ring cells)

**Medullary carcinoma**
- Micropapillary adenocarcinoma
- Serrated adenocarcinoma
- Squamous cell carcinoma
- Adenosquamous carcinoma
- Spindle cell carcinoma
- Poorly differentiated neuroendocrine carcinoma
- Large cell neuroendocrine carcinoma
- Small cell neuroendocrine carcinoma
- Mixed adenoneuroendocrine carcinoma
- Undifferentiated carcinoma

The histologic types of colorectal carcinoma that have been shown to have adverse prognostic significance independent of stage are signet-ring cell carcinoma² and small cell carcinoma (poorly differentiated neuroendocrine carcinoma).³

Medullary carcinoma is a distinctive histologic type strongly associated with high levels of microsatellite instability (MSI-H), indicative of defects in normal DNA repair gene function. Medullary carcinoma may occur either sporadically or in association with Lynch syndrome.³⁻⁶ This tumor type is characterized by solid growth in nested, organoid, or trabecular patterns, with no immunohistochemical evidence of neuroendocrine differentiation. Medullary carcinomas are also characterized by numerous tumor infiltrating lymphocytes and a better prognosis.

Micropapillary carcinoma is characterized by small, tight clusters of tumor cells in cleft-like spaces, and is often present in association with conventional adenocarcinoma. This variant is strongly associated with lymphovascular invasion and lymph node metastasis.⁷

Serrated adenocarcinomas are characterized by neoplastic glands showing prominent serrations, tumor cells with basal nuclei and eosinophilic cytoplasm, and no or minimal luminal necrosis. These tumors are thought to be related to traditional serrated adenomas and may have a more aggressive course than conventional adenocarcinoma.⁸

References


C. Histologic Grade

A number of grading systems for colorectal cancer have been suggested, but a single widely accepted and uniformly used standard for grading is lacking. Most systems stratify tumors into 3 or 4 grades as follows:

<table>
<thead>
<tr>
<th>Grade</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Well differentiated (&gt;95% gland formation)</td>
</tr>
<tr>
<td>2</td>
<td>Moderately differentiated (50-95% gland formation)</td>
</tr>
<tr>
<td>3</td>
<td>Poorly differentiated (&lt;50% gland formation)</td>
</tr>
<tr>
<td>4</td>
<td>Undifferentiated (no gland formation or mucin; no squamous or neuroendocrine differentiation)</td>
</tr>
</tbody>
</table>

Despite a significant degree of interobserver variability, histologic grade has been shown to be an important prognostic factor in many studies, with strong correlation between poor differentiation and adverse outcome. While some studies have stratified grade into a two-tiered low- and high-grade system, a three- or four-tier system is more commonly used for gastrointestinal carcinomas. The AJCC has specified use of a four-tiered grading system for colorectal cancer for the 8th edition of the TNM manual. Pathologists should use the four-tier histologic grading scheme as specified above to prevent errors in data recording. As per WHO, the grading scheme applies to adenocarcinoma, not otherwise specified, and not to histologic variants. For example, medullary carcinomas behave as low grade tumors even though they may appear poorly differentiated. This grading scheme is also not applicable to poorly differentiated neuroendocrine carcinomas.

References


D. Carcinoma in an Adenomatous Polyp: Microscopic Tumor Extension and High-Risk Features

Colorectal adenomas containing invasive adenocarcinoma that extends through the muscularis mucosa into the submucosa have been defined as *malignant polyps.* This term encompasses cases in which the entire polyp head is replaced by carcinoma and adenomas with focal malignancy, but the definition excludes adenomas with high-grade dysplasia or intramucosal carcinoma (invasive carcinoma limited to the lamina propria or invading no deeper than the muscularis mucosa), because these polyps possess negligible biological potential for metastasis.

Malignant polyps removed by endoscopic polypectomy require evaluation of histologic factors related to the risk of adverse outcome (ie, lymph node metastasis or local recurrence from residual malignancy) following polypectomy. Factors shown to have independent prognostic significance and are important in determining the need for further surgical treatment include:
- Histologic grade
- Status of the resection margin
- Lymphatic/venous vessel involvement

An increased risk of adverse outcome has been shown to be associated with:
- High-grade carcinoma
- Tumor at or less than 1 mm from the resection margin
- Lymphatic/venous vessel involvement

Reporting of additional histologic factors that have been advocated for assessing risk include tumor budding (note F), depth or area of submucosal invasion. Submucosal involvement has been divided into superficial, mid and deep levels for sessile polyps (Kikuch levels sm1, sm2 and sm3) for sessile polyps, and into four levels (head, neck, stalk and beyond stalk) in pedunculated polyps (Haggitt levels). Based on measurement, submucosal invasion more than 1 mm has been recognized as an adverse prognostic factor. However, it can be difficult to accurately assess the depth or extent of submucosal involvement due to improper orientation and absence of muscularis propria in these specimens.

References

E. Lymphovascular and Perineural Invasion
It is recommended that small vessel vascular invasion should be reported separately from venous (large vessel) invasion. Small vessel invasion indicates tumor involvement of thin-walled structures lined by endothelium, without an identifiable smooth muscle layer or elastic lamina. Small vessels include lymphatics, capillaries, and postcapillary venules. Small vessel invasion is associated with lymph node metastasis and has been shown to be an independent indicator of adverse outcome in several studies. The higher prognostic significance of extramural small vessel invasion has been suggested, but the importance of anatomic location in small vessel invasion (extramural or intramural) is not well defined.

Tumor involving endothelium-lined spaces with an identifiable smooth muscle layer or elastic lamina is considered venous (large vessel) invasion. Circumscribed tumor nodules surrounded by an elastic lamina on hematoxylin-eosin (H&E) or elastic stain are also considered venous invasion. Venous invasion can be extramural (beyond muscularis propria) or intramural (submucosa or muscularis propria). Extramural venous invasion has been demonstrated by multivariate analysis to be an independent adverse prognostic factor in multiple studies and is a risk factor for liver metastasis. The significance of intramural venous invasion is less clear.

Perineural invasion has been shown to be an independent indicator of poor prognosis. While some series did not find perineural invasion to be a significant predictive factor in stage II disease, many studies have confirmed its adverse effect on survival in stage II disease. Extramural perineural invasion may have a greater adverse prognostic effect, but the distinction between intramural and extramural perineural invasion has not been well studied.

References


F. Tumor Budding

The presence of single cells or small clusters of less than five cells at the advancing front of the tumor is considered as peritumoral tumor budding. Numerous studies have shown that high tumor budding in adenocarcinoma arising in polyp is a significant risk factor for nodal involvement, with tumor budding being the most significant factor in some studies. Different criteria for evaluating and reporting tumor budding have been followed in literature. An international tumor budding consensus conference (ITBCC) in 2016 recommended the following criteria for evaluating tumor budding:

1. Tumor budding counts should be done on H&E sections. In cases of obscuring factors like inflammation, immunohistochemistry for keratin can be obtained to assess the advancing edge for tumor buds, but the scoring should be done on H&E sections.

2. Tumor budding should be reported by selecting a "hotspot" chosen after review of all available slides with invasive tumor. The total number of buds should be reported in an area measuring 0.785 mm², which corresponds to 20x field in some microscopes (use appropriate conversion for other microscopes, see table below).

3. Both total number of buds and a three-tier score (based on 0.785 mm² field area) should be reported: low (0-4 buds), intermediate (5-9 buds) and high (10 or more buds). This is not a required element, but it is recommended that this feature be reported for cancers arising in polyps as well as for stage I and II cases.

<table>
<thead>
<tr>
<th>Objective Magnification:</th>
<th>20</th>
</tr>
</thead>
<tbody>
<tr>
<td>Eyepiece FN Diameter</td>
<td></td>
</tr>
<tr>
<td>Eyepiece FN Radius</td>
<td></td>
</tr>
<tr>
<td>Specimen FN Radius</td>
<td></td>
</tr>
<tr>
<td>Specimen Area</td>
<td></td>
</tr>
<tr>
<td>Normalization Factor</td>
<td></td>
</tr>
<tr>
<td>(mm)</td>
<td>(mm)</td>
</tr>
<tr>
<td>18</td>
<td>9,0</td>
</tr>
<tr>
<td>19</td>
<td>9,5</td>
</tr>
<tr>
<td>20</td>
<td>10,0</td>
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<tr>
<td>21</td>
<td>10,5</td>
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<td>22</td>
<td>11,0</td>
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<tr>
<td>23</td>
<td>11,5</td>
</tr>
<tr>
<td>24</td>
<td>12,0</td>
</tr>
<tr>
<td>25</td>
<td>12,5</td>
</tr>
<tr>
<td>26</td>
<td>13,0</td>
</tr>
</tbody>
</table>

Table. ITBCC Normalization Table for Reporting Tumor Budding According to Microscope.

To obtain tumor bud count for your field of view, divide by the normalization number.

References


**G. Polyps**

The adenocarcinoma can arise in adenomatous (tubular, tubulovillous, or villous) or serrated (sessile serrated adenoma/polyp or traditional serrated adenoma) polyp. Sessile serrated adenoma often develops cytologic dysplasia resembling tubular adenoma during neoplastic progression. These are presumed to be the precursors of right-sided adenocarcinomas with high levels of microsatellite instability (MSI-H).\(^1\)

**References**


**H. Ancillary Studies**

Universal testing for microsatellite instability and/or status of DNA mismatch repair enzymes by immunohistochemistry is recommended by the EGAPP guidelines.\(^1,2\) The NCCN guidelines also advocate this approach for patients <70 years. MSI-high cancers are associated with right-sided location, tumor infiltrating lymphocytes, Crohn-like infiltrate, pushing borders, mucinous/signet ring/medullary subtypes, intratumoral heterogeneity (mixed conventional, mucinous, and poorly differentiated carcinoma), high-grade histology, and lack of dirty necrosis.\(^3,4\) In view of recommendations for universal testing and chance of missing cases of Lynch syndrome with testing based on Bethesda guidelines,\(^4\) evaluation of histologic features associated with MSI is not required and is no longer included in the synoptic comment.

Further details about mismatch repair enzyme immunohistochemistry and PCR for MSI testing, as well as other mutation testing in colorectal cancer (such as *KRAS*, *BRAF*) can be found in the CAP Colon and Rectum Biomarkers protocol.

**References**


