INTRODUCTION

The TNM classification for carcinomas of the colon and rectum provides more detail than other staging systems. Compatible with the Dukes’ system, the TNM adds greater precision in the identification of prognostic subgroups. TNM staging is based on the depth of tumor invasion into the wall of the intestine (T), extension to adjacent structures (T), the number of regional lymph nodes involved (N), and the presence or absence of distant metastasis (M). The TNM classification applies to both clinical and pathologic staging. However, most cancers of the colon or rectum are staged after pathologic examination of the surgical resection specimen. This staging system applies to all carcinomas arising in the colon or rectum. Adenocarcinomas of the vermiform appendix may be classified according to the TNM staging system but should be recorded separately. Since stage-specific outcomes may differ from colorectal carcinomas. Cancers that occur in the anal canal are staged according to the classification used for the anus (see Chapter 13).
ANATOMY

The anatomical subsites of the colon and rectum are illustrated in Figures 12.1 and 12.2, respectively. The divisions of the colon and rectum are as follows:

Cecum
Ascending colon
Hepatic flexure
Transverse colon
Splenic flexure
Descending colon
Sigmoid colon

FIGURE 12.1. Anatomic subsites of the colon.

Rectosigmoid junction
Rectum

FIGURE 12.2. Anatomic subsites of the rectum.
Rectosigmoid colon
Rectum

Primary Site. The large intestine (colorectum) extends from the terminal ileum to the anal canal. Excluding the rectum and vermiform appendix, the colon is divided into four parts: the right or ascending colon, the middle or transverse colon, the left or descending colon, and the sigmoid colon. The sigmoid is continuous with the rectum, which terminates at the anal canal.

The cecum is a large, blind pouch that arises from the proximal segment of the right colon. It measures 6 cm by 9 cm and is covered with peritoneum. The ascending colon measures 15–20 cm in length. The posterior surface of the ascending (and descending) colon lacks peritoneum and thus is in direct contact with the retroperitoneum. In contrast, the anterior and lateral surfaces of the ascending (and descending) colon have serosa and are intraperitoneal. The hepatic flexure connects the ascending colon with the transverse colon, passing just inferior to the liver and anterior to the duodenum.

The transverse colon is entirely intraperitoneal, supported on a long mesentery that is attached to the pancreas. Anteriorly, its serosa is continuous with the gastrocolic ligament. The splenic flexure connects the transverse colon to the descending colon, passing inferior to the spleen and anterior to the tail of the pancreas. As noted above, the posterior aspect of the descending colon lacks serosa and is in direct contact with the retroperitoneum, whereas the lateral and anterior surfaces have serosa and are intraperitoneal. The descending colon measures 10–15 cm in length. The colon becomes completely intraperitoneal once again at the sigmoid colon, where the mesentery develops at the medial border of the left posterior major psoas muscle and extends to the rectum. The transition from sigmoid colon to rectum is marked by the fusion of the tenia of the sigmoid colon to form the circumferential longitudinal muscle of the rectum. This occurs roughly 12–15 cm from the dentate line.

Approximately 12 cm in length, the rectum extends proximally from the fusion of the tenia to the puborectalis ring distally. The rectum is covered by peritoneum in front and on both sides in its upper third and only on the anterior wall in its middle third. The peritoneum is reflected laterally from the rectum to form the perirectal fossa and, anteriorly, the uterine or rectovesical fold. There is no peritoneal covering in the lower third, which is often known as the rectal ampulla. The anal canal, which measures 3–5 cm in length, extends from the puborectalis sling to the anal verge.

Regional Lymph Nodes. Regional nodes are located (1) along the course of the major vessels supplying the colon and rectum, (2) along the vascular arcades of the marginal artery, and (3) adjacent to the colon—that is, located along the mesocolic border of the colon. Specifically, the regional lymph nodes are the pericoloic and perirectal nodes and those found along the ileocolic, right colic, middle colic, left colic, inferior mesenteric artery, superior rectal (hemorrhoidal), and internal iliac arteries (Figure 12.3).

For pN, the number of lymph nodes sampled should be recorded. The number of nodes examined from an operative specimen has been reported to be associated with improved survival, possibly because of increased accuracy in
staging. It is important to obtain at least 12–14 lymph nodes in radical colon and rectum resections; however, in cases in which tumor is resected for palliation or in patients who have received preoperative radiation, only a few lymph nodes may be present. A pN0 determination may be assessed when these nodes are histologically negative, even though fewer than the recommended number of nodes have been analyzed.

The regional lymph nodes for each segment of the large bowel are designated as follows:

<table>
<thead>
<tr>
<th>Segment</th>
<th>Regional Lymph Nodes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cecum</td>
<td>Pericolic, anterior cecal, posterior cecal, ileocolic, right colic</td>
</tr>
<tr>
<td>Ascending colon</td>
<td>Pericolic, ileocolic, right colic, middle colic</td>
</tr>
<tr>
<td>Hepatic flexure</td>
<td>Pericolic, middle colic, right colic</td>
</tr>
<tr>
<td>Transverse colon</td>
<td>Pericolic, middle colic</td>
</tr>
<tr>
<td>Splenic flexure</td>
<td>Pericolic, middle colic, left colic, inferior mesenteric</td>
</tr>
<tr>
<td>Descending colon</td>
<td>Pericolic, left colic, inferior mesenteric, sigmoid</td>
</tr>
<tr>
<td>Sigmoid colon</td>
<td>Pericolic, inferior mesenteric, superior rectal (hemorrhoidal), sigmoidal, sigmoid mesenteric</td>
</tr>
<tr>
<td>Rectosigmoid</td>
<td>Pericolic, perirectal, left colic, sigmoid mesenteric, sigmoidal, inferior mesenteric, superior rectal (hemorrhoidal), middle rectal (hemorrhoidal)</td>
</tr>
<tr>
<td>Rectum</td>
<td>Perirectal, sigmoid mesenteric, inferior mesenteric, lateral sacral presacral, internal iliac, sacral promontory (Gerota’s), superior rectal (hemorrhoidal), middle rectal (hemorrhoidal), inferior rectal (hemorrhoidal)</td>
</tr>
</tbody>
</table>

**FIGURE 12.3.** The regional lymph nodes of the colon and rectum.
Metastatic Sites. Although carcinomas of the colon and rectum can metastasize to almost any organ, the liver and lungs are the most common sites. Seeding of other segments of the colon, small intestine, or peritoneum can also occur.

DEFINITIONS

Primary Tumor (T)
TX  Primary tumor cannot be assessed
T0  No evidence of primary tumor
Tis  Carcinoma in situ: intraepithelial or invasion of lamina propria
T1  Tumor invades submucosa (Figure 12.4)
T2  Tumor invades muscularis propria (Figure 12.5)
T3  Tumor invades through the muscularis propria into the subserosa, or into nonperitonealized pericolic or perirectal tissues (Figure 12.6)
T4  Tumor directly invades other organs or structures (Figures 12.7A–C), and/or perforates visceral peritoneum (Figures 12.7C, D)
FIGURE 12.6. T3 tumor invades through the muscularis propria into the subserosa or into nonperitonealized pericolic, or perirectal tissues (adventitia).

FIGURE 12.7. A. T4 tumor directly invades other organs or structures (such as the coccyx shown here), and/or perforates visceral peritoneum. B. T4 tumor directly invades other organs or structures, and/or perforates visceral peritoneum, as illustrated here with radial extension into an adjacent loop of small bowel.
Regional Lymph Nodes (N)

NX  Regional lymph nodes cannot be assessed
N0  No regional lymph node metastasis
N1  Metastasis in 1 to 3 regional lymph nodes (Figure 12.8)
N2  Metastasis in 4 or more regional lymph nodes (Figures 12.9A–C)

Distant Metastasis (M)

MX  Distant metastasis cannot be assessed
M0  No distant metastasis
M1  Distant metastasis (Figure 12.10)

Residual Tumor (R)

R0  Complete resection, margins histologically negative, no residual tumor left after resection
R1  Incomplete resection, margins histologically involved, microscopic tumor remains after resection of gross disease.
R2  Incomplete resection, margins involved or gross disease remains after resection (Figure 12.11)

FIGURE 12.7. C. T4 tumor directly invades other organs or structures (such as adjacent bowel, shown right), and/or perforates visceral peritoneum (shown left with gross bowel perforation through the tumor). D. T4 tumor directly invades other organs or structures, and/or perforates (penetrates) visceral peritoneum, as illustrated here.
FIGURE 12.8. Two views of N1, which is defined as metastasis in 1 to 3 regional lymph nodes.

FIGURE 12.9. A. Two views of N2, which is defined as metastasis in 4 or more regional lymph nodes.
Figure 12.9. B. Two views of N2 which is defined as metastasis in 4 or more regional lymph nodes. C. N2 showing nodal masses in more than 4 regional lymph nodes.
FIGURE 12.10. M1 disease is defined as distant metastasis, in this case outside the regional nodes of the primary tumor.

FIGURE 12.11. T4 (left side) has perforated the visceral peritoneum in a segment of the colorectum with a serosal covering. In contrast, T3; R2 (right side) shows macroscopic involvement of the circumferential resection margin of a nonperitonealized surface of the colorectum by tumor corresponds to gross disease remaining after surgical excision).
### STAGE GROUPING

<table>
<thead>
<tr>
<th>Stage</th>
<th>T</th>
<th>N</th>
<th>M</th>
<th>Dukes</th>
<th>MAC</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>Tis</td>
<td>N0</td>
<td>M0</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>I</td>
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<td>N0</td>
<td>M0</td>
<td>A</td>
<td>A</td>
</tr>
<tr>
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<td>N0</td>
<td>M0</td>
<td>A</td>
<td>B1</td>
</tr>
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<td>T3</td>
<td>N0</td>
<td>M0</td>
<td>B</td>
<td>B2</td>
</tr>
<tr>
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<td>T4</td>
<td>N0</td>
<td>M0</td>
<td>B</td>
<td>B3</td>
</tr>
<tr>
<td>III A</td>
<td>T1–T3</td>
<td>N1</td>
<td>M0</td>
<td>C</td>
<td>Cl</td>
</tr>
<tr>
<td>III B</td>
<td>T3–T4</td>
<td>N1</td>
<td>M0</td>
<td>C</td>
<td>C2/C3</td>
</tr>
<tr>
<td>III C</td>
<td>Any T</td>
<td>N2</td>
<td>M0</td>
<td>C</td>
<td>C1/C2/C3</td>
</tr>
<tr>
<td>IV</td>
<td>Any T</td>
<td>Any N</td>
<td>M1</td>
<td>—</td>
<td>D</td>
</tr>
</tbody>
</table>

### NOTES

1. Tis includes cancer cells confined within the glandular basement membrane (intraepithelial) or lamina propria (intramucosal) with no extension through the muscularis mucosae into the submucosa.

2. Direct invasion in T4 includes invasion of other segments of the colorectum by way of the serosa, for example, invasion of the sigmoid colon by a carcinoma of the cecum.

3. Tumor that is adherent to other organs or structures, macroscopically, is classified T4. However, if no tumor is present in the adhesion, microscopically, the classification should be pT3. The V and L substaging should be used to identify the presence or absence of vascular or lymphatic invasion.

4. A tumor nodule in the pericolorectal adipose tissue of a primary carcinoma without histologic evidence of residual lymph node in the nodule is classified in the pN category as a regional lymph node metastasis if the nodule has the form and smooth contour of a lymph node. If the nodule has an irregular contour, it should be classified in the T category and also coded as V1 (microscopic venous invasion) or as V2 (if it was grossly evident), because there is a strong likelihood that it represents venous invasion.