

Tumor Classification: Staging and Grading

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Malignant neoplasms are among the leading causes of death; in the United States, they are currently second only to cardiovascular disease. As an aspiring medical professional, you will encounter cancer in nearly every clinical field. Although tumors can be widely varied, characterization through staging and grading is almost universally applicable. Both indicators can help with decisions about prognosis and treatment. In this article, you will learn the appropriate terminology and how to classify and distinguish among different types of tumors.



Grading

Grading is based on the **histologic assessment of tumor cells according to their state of differentiation. Differentiation in the microscopic appearance of tumor cells determines the grade.** Tumor cells are grouped into 4 types based on how they resemble and differ from healthy cells. Well-differentiated tumors (low grade) generally have a **better prognosis** than poorly differentiated tumors (high grade).

G1	Well-differentiated—close similarity to original tissue (low grade)
G2	Somewhat differentiated malignant tissue (intermediate grade)
G3	Poorly differentiated malignant tissue (high grade)

G4	Undifferentiated malignant tissue—the original tissue that gave rise to the tumor can be determined only by immunohistochemical evaluation or not at all (high grade)
G9	Cannot gauge level of differentiation (undetermined grade)

This grading is performed for most types of tumors, but there are a few exceptions. Prostate tumors are evaluated histologically according to the **Gleason score**, breast tumors are assessed with the **Nottingham grading system**, and brain tumors have a specific World Health Organization classification.

Tumor grade is evaluated by visual and microscopic examination of tumor cells during surgery or biopsy.

Note: Grading describes the grade of the histologic change of tumor tissue versus the neighboring healthy tissue.

Staging

Staging of a tumor can be determined by its size and the extent to which it has spread throughout the body. Tumor staging is performed with different laboratory tests such as radiography, ultrasonography, computed tomography scanning, etc. Solid tumors are usually classified with the TNM system. This system has been administered by the **UICC** (Union Internationale Contre le Cancer) since the 1950s, and it is regularly updated.

The letters T, N, and M stand for separate categories: **t**umor (size and extent of the primary tumor), **n**ode (involvement of neighboring lymph nodes), and status of **m**etastases, respectively.

T: primary tumor	Tx: Primary tumor cannot be measured T0: Absence of primary tumor T1–T4: Assignment of various stages according to the specific type of tumor, taking into account different criteria such as size (diameter), invasive depth, and infiltration of neighboring tissue and organs
N: involvement of lymph nodes	Nx: Involvement of neighboring lymph nodes cannot be assessed N0: No involvement of neighboring lymph nodes N1–3: Number and localization of involved lymph nodes developing cancer
M: distant metastases	Mx: Distant metastases cannot be assessed M0: No metastases M1: Distant metastases observed

An example of a **tumor description** according to the TNM classification could be T1N0M0. This would mean that the tumor has only moderate localized spread, does not affect any lymph nodes, and has no distant metastases.

Lowercase letters that precede the TNM code help provide **additional information**. For example, 'a' means that a tumor was discovered by means of an autopsy, 'c' indicates a clinical diagnosis, 'p' specifies confirmation of the stage through pathologic evaluation, 'y' means previous neoadjuvant therapy, and 'r' indicates recurrence.

The TNM system is further divided into the following 5 stages:

Stage 0	There is marked growth of abnormal cells, which have not spread to neighboring tissue but have the potential to develop into a tumor (also termed carcinoma in situ)
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Stage I, Stage II, and Stage III	Assignment of various stages occurs according to the specific type of tumor, taking into account different criteria such as size (diameter), invasive depth, and infiltration of neighboring tissue
Stage IV	Metastasis to different organs

The combination of all 3 categories determines the **tumor stage**. The criteria for staging are specifically defined according to tumor type and are based on the **statistical analysis of stage-specific prognosis** and corresponding treatment options.

Staging is a routine part of tumor diagnostics because it has considerable influence on the course of treatment. Important diagnostic procedures for tumor staging involve radiologic modalities such as ultrasonography, computed tomography, and x-ray imaging (for determining tumor size and local spread, lymph node involvement, and distant metastases); nuclear medicine techniques; and tissue sampling for histologic, immunohistochemical, and/or cytologic examination.

Note: Staging describes the totality of all indicated examinations that are necessary to determine malignant tumor spread. Observations are described by TNM classification and are assigned to a specific stage.

References

[National Cancer Institute](#)

AJCC Cancer Staging Manual. 7th ed. New York, NY: Springer; 2010

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