# Grading, Staging, and Reporting of Soft Tissue Tumors

# 3

## 3.1 Assigning a Pathologic Grade to Soft Tissue Tumors

As with most other malignancies, soft tissue sarcomas are assigned a histological grade. The French Federation of Cancer Centers Sarcoma Group (FNCLCC) is the most commonly used methodology and is preferred by the American Joint Committee on Cancer (AJCC) [1]. This system assesses tumor differentiation, mitosis, and necrosis and assigns a score for each characteristic (Table 3.1) [2, 3].

The differentiation score generally reflects how closely the tumor resembles benign mesenchymal tissue. For example, a well-differentiated liposarcoma (which closely mimics adipose tissue) would receive a low score (of 1), and a dedifferentiated liposarcoma (which has lost its lipogenic differentiation) would receive a high score (of 3).

A mitotic score is assigned according to the number of mitosis identified after viewing ten standard high-power fields through the microscope. One point is assigned for 0–9 mitosis, two points are assigned for 10–19 mitosis, and three points are assigned for 20 or more mitosis over ten high-power fields.

A necrosis score is rendered according to the amount of tumor necrosis present. Two points are assigned for more than 50% necrosis. One point is assigned for less than 50% necrosis, and no points are assigned if there is no necrosis.

These scores are then summated, and a numeric grade (1–3) is assigned accordingly (Table 3.2). This approach successfully categorizes a diverse group of malignant soft tissue sarcomas in a manner that independently predicts metastasis, but it is not used for all sarcomas. Some tumors that are classified as "malignant," such as epithelioid sarcoma, clear cell sarcoma, and alveolar soft part sarcoma, carry less risk for early (less than 5 years) metastasis and greater risk for late metastasis (greater than 5 years). Consequently, these tumors are not given an FNCLCC grade. Other tumors, like alveolar or embryonal rhabdomyosarcoma, have their own risk stratification system (such as the Intergroup Rhabdomyosarcoma Study Postsurgical Clinical Grouping System) and are not assigned a FNCLCC grade [4].


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**Table 3.1** Scoring parameters for the FNCLCC grading system [5, 6]

| **Histologic type** | **Score** |
|---|---|
| Well-differentiated liposarcoma | 1 |
| Myxoid liposarcoma | 2 |
| Round cell liposarcoma | 3 |
| Pleomorphic liposarcoma | 3 |
| Dedifferentiated liposarcoma | 3 |
| Fibrosarcoma | 2 |
| Myxofibrosarcoma MFH | 2 |
| Pleomorphic sarcoma NOS, with giant cell or inflammatory cells | 3 |
| Well-differentiated leiomyosarcoma | 1 |
| Conventional leiomyosarcoma | 2 |
| Poorly differentiated, pleomorphic or epithelioid leiomyosarcoma | 3 |
| Biphasic or monophasic synovial sarcoma | 3 |
| Poorly differentiated synovial sarcoma | 3 |
| Pleomorphic rhabdomyosarcoma | 3 |
| Mesenchymal chondrosarcoma | 3 |
| Extraskeletal osteosarcoma | 3 |
| Ewing sarcoma | 3 |
| Malignant rhabdoid tumor | 3 |
| Undifferentiated (spindle cell and pleomorphic) sarcoma | 3 |
| **Tumor mitosis** | **Score** |
| 0–9 mitoses per 10 high-power fields | 1 |
| 10–19 mitoses per 10 high-power fields | 2 |
| Greater than 19 mitoses per 10 high-power fields | 3 |
| **Tumor necrosis** | **Score** |
| No tumor necrosis | 0 |
| Less than 50% tumor necrosis | 1 |
| 50% or more tumor necrosis | 2 |

Points are assigned for tumor differentiation, mitosis, and necrosis

**Table 3.2** Grade assignment for the FNCLCC grading system. After points are assigned for tumor differentiation, mitosis, and necrosis, a grade (1–3) is assigned according to the total score calculated

| FNCLCC grading of soft tissue tumors | |
|---|---|
| Grade 1 | 2–3 points |
| Grade 2 | 4–5 points |
| Grade 3 | 6–8 points |

Grading can be challenging on needle core biopsies, primarily due to issues with sampling. Biopsies that fail to capture increased mitosis or tumor necrosis can result in assignment of an inaccurate lower grade [2]. Thus, it is important to consider a reported grade in light of the radiologic findings when determining whether or not the biopsy is representative.

Often, intermediate or high-grade soft tissue tumors receive neoadjuvant radiation or chemotherapy. Following presurgical therapy, it is impossible to distinguish between original tumor necrosis and treatment-related necrosis on the resection specimen. Also, this neoadjuvant therapy will artificially lower the mitotic rate, and resected soft tissue neoplasms treated with neoadjuvant therapy are not eligible for grading. The grade listed for a previously treated resected tumor is assigned based on the original biopsy.

## 3.2 Assigning a Pathologic Stage to Soft Tissue Tumors

Similar to carcinomas, resected sarcomas are assigned a pathologic stage according to the American Joint Committee on Cancer (AJCC) staging system (Table 3.3). This follows a TNM format that reports a value for the primary tumor (T stage), involvement of lymph nodes (N stage), and presence of metastasis (M stage). In soft tissue pathology, size has been the primary determinant for calculating the T stage. Recently, the eighth edition of the AJCC Cancer Staging Manual has been published and will be clinically implemented on January 1, 2018. To better account for location in predicting local recurrence or metastatic disease, there are now particular staging definitions for sarcomas in specific anatomic sites. Categories include the head and neck, trunk/extremities, abdominal/thoracic viscera and retroperitoneum. In the abdominal/thoracic viscera, T stage of a tumor is primarily defined by the amount of extension from the primary organ. In the other sites, size remains the principle determinant of T categorization [1, 5].

In the 8th edition of the AJCC Cancer Staging Manual, the N stage is categorized as “N0” when the regional lymph nodes are negative for tumor or if the lymph node status is unknown. Tumors that have an involved lymph node are classified as “N1.” If distant metastasis is pathologically documented, a designation of “M1” is given. If not, the tumor is designated as “M0”.

When the pathology stage is listed on the report, it frequently begins with the prefix of “p” and continues with a value for the T, N, and M components.

In tumors that have received neoadjuvant therapy, the pathologic stage is first preceded by a “y” prefix.[1].

## 3.3 Interpreting a Soft Tissue Pathology Report

Pathology diagnoses include an increasing amount of data elements from the gross examination, microscopic interpretation, and supporting immunohistochemical and molecular studies of a case. Developing an understanding of these elements and the general structure of a pathology report can help facilitate communication within the treatment group. While the exact format and approach to reporting varies between institutions, there are common principles that can be discussed.

**Table 3.3a** AJCC categorization (8th edition) for T staging of soft tissue tumors

| **Primary tumor (T) for soft tissue sarcomas of the head and neck** | |
|---|---|
| TX | Primary tumor cannot be assessed |
| T1 | Tumor ≤2 cm |
| T2 | Tumor >2 to ≤4 cm |
| T3 | Tumor >4 cm |
| T4 | Tumor with invasion of adjoining structures |
| T4a | Tumor with orbital invasion, skull base/dural invasion, invasion of central compartment viscera, involvement of facial skeleton, or invasion of pterygoid muscles |
| T4b | Tumor with brain parenchymal invasion, carotid artery encasement, prevertebral muscle invasion, or central nervous system via perineural spread |
| **Primary tumor (T) for soft tissue sarcomas of the trunk and extremities** | |
| TX | Primary tumor cannot be assessed |
| T0 | No evidence of primary tumor |
| T1 | Tumor 5 cm or less in greatest dimension |
| T2 | Tumor more than 5 cm and less than or equal to 10 cm in greatest dimension |
| T3 | Tumor more than 10 cm and less than or equal to 15 cm in greatest dimension |
| T4 | Tumor more than 15 cm in greatest dimension |
| **Primary tumor (T) for soft tissue sarcomas of the abdomen and thoracic visceral organs** | |
| TX | Primary tumor cannot be assessed |
| T1 | Organ confined |
| T2 | Tumor extension into tissue beyond organ |
| T2a | Invades serosa or visceral peritoneum |
| T2b | Extension beyond serosa (mesentery) |
| T3 | Invades another organ |
| T4 | Multifocal involvement |
| T4a | Multifocal (2 sites) |
| T4b | Multifocal (3–5 sites) |
| T4c | Multifocal (>5 sites) |
| **Primary tumor (T) for soft tissue sarcomas of the retroperitoneum** | |
| TX | Primary tumor cannot be assessed |
| T0 | No evidence of primary tumor |
| T1 | Tumor 5 cm or less in greatest dimension |
| T2 | Tumor more than 5 cm and less than or equal to 10 cm in greatest dimension |
| T3 | Tumor more than 10 cm and less than or equal to 15 cm in greatest dimension |
| T4 | Tumor more than 15 cm in greatest dimension |

The criterion for assignment depends on the anatomic location in which the tumor arises

**Table 3.3b** AJCC categorization (8th edition) for N and M staging of soft tissue tumors

| **Regional lymph nodes (N)** | |
|---|---|
| N0 | No regional lymph node metastasis or unknown lymph node status |
| N1 | Regional lymph node metastasis |
| **Distant metastasis (M)** | |
| M0 | No distant metastasis |
| M1 | Distant metastasis |

**Patient and Specimen Identifiers**
Pathology reports will generally contain at least two patient identifiers at the heading of each page of a report. These can include the patient's name, medical record number, and date of birth. Given the substantial impact a pathology report will have on patient care, laboratory personnel vigilantly confirm and reconfirm that these identifiers match those on the received requisition form and containers. Nevertheless, developing a habit of checking these patient identifiers when reviewing a report can help the clinician prevent a rare but potentially egregious patient identification error.

**Gross Examination**
The gross examination includes the findings seen by a pathologist or pathology assistant when receiving a surgical specimen in the lab. For simplification, each container received is generally labeled as a specific part (e.g., part A, part B, part C, etc.). When reviewing the gross examination for a needle core biopsy, a clinician can confirm that the amount and length of the biopsies received correspond to what was submitted. However, it should be understood that needle core biopsies shrink from formalin fixation and occasionally fragment in transport. For resection specimens, a physician can confirm that directions regarding the orientation of the specimen were correctly interpreted. Additionally, the size of the tumor can be compared to the radiologic examination, and the reported gross distance of the tumor from the surgical margins can be correlated with the intraoperative impression.

**Microscopic Examination**
The microscopic examination includes a description of histologic features, immunohistochemical stains, or molecular tests ordered to arrive at the diagnosis.

**Final Diagnosis**
The final diagnosis includes the most critical elements of the report such as the histologic classification and margin status.

**Diagnostic Comment**
The diagnostic comment expresses important information that does not conform to other listed categories. This can include opinions from outside experts who were consulted on the case. Insights into anticipated clinical behavior or suggestions for follow-up treatment can also be included in this section.

**Synoptic Report**
The synoptic report summarizes the information from all other parts of the document into a standardized format that is easily readable and searchable. The elements included in the report are suggested by professional organizations such as the College of American Pathology and include items such as type of procedure, tumor site, tumor size, histologic type, mitosis, necrosis, grade, margins, and pathologic stage [1, 6].

Familiarity with the elements and structure of a pathology report can help streamline communication between the treating physician and pathologists. If questions arise about the wording or findings, a direct telephone call can be enormously helpful in providing greater clarity.

**Facts to Remember**

1. Malignant sarcomas are usually assigned a FNCLCC grade based on mitosis, necrosis, and how closely they resemble benign connective tissue.
2. The tumor grade rendered on biopsies can be affected by sampling and should be interpreted in the context of radiologic imaging.
3. Tumors treated with adjuvant therapy are graded based on the original biopsy.
4. Sarcomas are assigned an AJCC stage based on parameters such as size and extent of tumor. The criteria for T categorization depends on the anatomic location of the malignancy.
5. With the increasingly nuanced characterization of soft tissue malignancies, familiarity with a laboratories reporting format is critical for successful coordination of diagnosis and treatment.

## References

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