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REVIEW ARTICLE

Association of Directors of Anatomic and Surgical Pathology

Recommendations for the reporting of soft tissue sarcoma

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Abstract The Association of Directors of Anatomic and Surgical Pathology has developed recommendations for the surgical pathology reporting of common malignant tumors. The recommendations for soft tissue sarcomas are reported herein.

Key words Soft tissue tumors · Sarcomas

Introduction

The Association of Directors of Anatomic and Surgical Pathology (ADASP) has named committees to develop recommendations regarding the content of the surgical pathology report of common malignant tumors. A committee of individuals with special interest and expertise write the recommendations, which are reviewed and approved by the council of ADASP and subsequently by the entire membership.

The recommendations have been divided into four major areas:

1. Items that provide an informative gross description;
2. Additional diagnostic features that are recommended for inclusion in every report if possible;
3. Optional features that may be included in the final report;
4. A checklist (see appendix).

The purpose of these recommendations is to provide an informative report for the clinician. The recommendations are intended as suggestions, and adherence to them is completely voluntary. In special clinical circumstances, the recommendations may not be applicable. The recommendations are intended as an educational resource rather than a mandate.

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Features to be included in the final pathology report

These recommendations are designed for the handling of commonly resected soft tissue sarcomas and, as such, are applicable most often to tumors from adult and adolescent patients. Because surgical resection less often has a central role in the management of pediatric sarcomas (particularly those of the round cell type), because the majority of such cases are pretreated by chemotherapy, and because the staging and grading systems used in the pediatric setting are quite different from those used for the more frequent adult lesions, these recommendations will not usually be applicable to tumors from children. However, these guidelines can still be used for the minority of pediatric cases that are treated primarily by surgical excision.

It is important to note that some parts of these recommendations cannot be applied easily to the growing number of adult sarcomas that have been pretreated with radiotherapy and/or chemotherapy. The changes commonly induced by such therapy often make definitive histological typing and grading impossible. Furthermore, there are neither reliable methods nor established criteria for distinguishing treatment effects (e.g. necrosis or fibrosis) from spontaneous tumor cell necrosis or other degenerative changes.

Although not strictly related to the reporting of formal resection specimens, the Association offers the following guidelines regarding the increasing use of needle biopsy in soft tissue tumor diagnosis.

1. The principal role of needle biopsy is to document the presence of malignancy and to establish, if possible, whether a lesion is mesenchymal or not (i.e. to try to rule out metastatic carcinoma, melanoma and lymphoma); precise typing and grading are often not possible

and certainly are not mandatory on such limited material, although some biopsies may show obviously high-grade tumor.
2. Needle biopsies are prone to sampling error and may not provide adequate material for diagnosis; pathologists should not be reluctant to request additional tissue (e.g. an incisional biopsy) when appropriate.
3. Because of potential sampling problems, grading rendered on the basis of a needle biopsy may be an underestimate; unless obvious high-grade tumor is present it is often inappropriate to provide a definitive grade.
4. While acknowledging the clinical convenience of needle biopsy (especially in diagnosing tumor relapse), the Association is concerned (a) that the relative rarity and morphologic heterogeneity of soft tissue tumors render them susceptible to misdiagnosis by this technique and (b) that the increasing use of needle biopsy followed by preoperative therapy may lead to significant loss of useful pathological and prognostic information. The Association, however, acknowledges that current oncological fashion in some centers favors this operational combination. Pathologists may therefore sometimes have to make do with such limited material and hence may more often resort to a diagnosis of unclassified sarcoma or malignant fibrous histiocytoma (MFH).

The following are recommendations for handling resections specimens:

Gross description

1. How the specimen was received – fresh or in formalin, uncut or cut, oriented or not, margins inked or not.

Note: The Association recommends that, whenever possible, biopsies and resections of soft tissue sarcomas are received unfixed in the pathology laboratory (or frozen section room) as soon as possible after excision. This facilitates optimal utilization of special studies (see below) and minimizes artifactual distortion of specimen orientation and margins. The Association further recommends that, whenever possible, the precise orientation of a resection specimen be verified with the help of one of the operating surgeons.

2. How the specimen was labeled/identified and whether patient details correspond to those on the accompanying request form.
3. The type of procedure that was performed (where known or stated): excisional biopsy, simple or local excision, wide local excision, compartmentectomy, radical excision, amputation (state the type).
4. Measurements of the specimen and record of the tissues included: skin, subcutaneous fat, fascia, skeletal muscle (identify when possible), periosteum or bone, major neurovascular bundles, attached organs (for thoraco-abdominal, pelvic or retroperitoneal tumors).

Note: The closest resection margins (identified visually or by palpation) should be inked. It may not be necessary to ink the entire specimen margin (unless small) since this may be associated with misleading seepage of ink. If time allows, margins are always more easily assessed after 6–12 h fixation, since firmer tissues are more easily cut without distortion.

5. Tumor description

(a) Size of the tumor (cm; preferably in three dimensions).
(b) Depth of the tumor where evident (e.g. dermal, subcutaneous, fascial, subfascial, intramuscular, visceral or more than one of these).
(c) Presence or absence of necrosis – if present the approximate percentage of tumor involved should be stated, based upon serial slicing.

Note: The significance of necrosis in pretreated soft tissue sarcomas is unknown at present but the extent of necrosis in such specimens should not be used as a grading parameter.

(d) Appearance and texture of the tumor cut surface (e.g. color, firm/soft, fatty, gelatinous, calcified, hemorrhagic).
(e) Presence or absence of previous biopsy site or scar, with dimensions and relationship to present resection margins.
(f) Involvement or invasion of major structures such as nerve, bone, major blood vessels.
(g) Presence of satellite nodules of tumor distant from the main mass – if present their maximum dimension should be measured; as should the minimum distance to closest resection margin.
(h) Presence of lymph nodes, along with size and description of cut surface.

Note: Lymph node dissection is not a routine component of the surgical management of most soft tissue sarcomas. Lymph nodes are not present in the majority of limb resection specimens, and lymph node involvement is very uncommon except in certain specific tumor types e.g. angiosarcoma, epithelioid sarcoma, synovial sarcoma.

(i) Measured minimum distance to margins; as a minimum, all margins that are less than 2 cm should be measured and specified in the final report. Most specimens have six margins – superficial/deep, proximal/distal, medial/lateral; if a margin consists of either a fascial layer, periosteum or other anatomical barrier (e.g. diaphragm) this should be specified.
(j) Note of letter or number specifying the location or orientation (where pertinent, e.g. margins) of each tissue block taken for routine processing.

Note: The Association recommends sampling of all areas which appear different macroscopically with an overall block number (in most cases) of approximately 1 per cm of the tumor's greatest dimension. For very large tumors (e.g. retroperitoneal) it is rarely necessary to take more than a total of 10–12 blocks of tumor. The Association also advocates the use of perpendicular (rather than en face) blocks from margins

in soft tissue sarcoma. Any margin macroscopically more than 5 cm clear generally need not be sampled, except in cases of epithelioid sarcoma and angiosarcoma, which are prone to subclinical proximal or satellite spread; conversely, any margin closer than 1.5–2 cm is a potential source of concern and en face sampling of such margins is not sufficiently sensitive in this specific setting.

(k) Tissue taken for special studies (e.g. electron microscopy, snap-freezing, cytogenetic analysis or DNA flow cytometry) should be specified.

Diagnostic information

1. Site and depth of tumor.
2. Histological type (use WHO system [10] when possible – a simplified classification scheme is also provided in *Appendix 1*); if tumor type is unknown then the term 'unclassified sarcoma' with a qualifier such as pleomorphic, spindle cell, myxoid or round cell is useful.
3. Maximal dimension of tumor (cm).
4. Histological grade.

Note: The Association acknowledges that most published grading systems for soft tissue sarcomas correlate with outcome. However no existing system is perfect and some specific tumor types are either high or low grade by definition, while others are not susceptible to meaningful grading (e.g. alveolar soft part sarcoma, clear cell sarcoma, epithelioid sarcoma) – see *Appendix 2*. For these reasons histological grading is often somewhat subjective, and the Association does not believe that use of any specific published grading sytem should be mandatory at this time. The two systems used most widely are those of the French (FNCLCC) [1, 2, 9] and the National Cancer Institute (NCI) [3, 4]. Either system may be used so long as this is clearly stated in the report. Most recent data demonstrate that the FNCLCC system is more effective [5], but the Association acknowledges that there remains a need for future refinement in histological grading of soft tissue sarcomas.

5. Minimum distance(s) to resection margins – any margin less than 2 cm from the tumor should be specified in terms of location and distance.

Note: It is believed generally that surgical margins of less than 1.5–2 cm in soft tissue sarcoma predispose to an increased risk of local recurrence unless further surgery or irradiation is undertaken. However, if a surgical margin is bounded by an unbreached layer of fascia or periosteum this risk probably does not apply [7], but such margins should still be measured if close.

6. Histological evidence of a pre-existing benign lesion (only applicable to nerve sheath neoplasms).
7. Lymph node status (if present).
8. Results of any special investigations (e.g. special stains, immunohistochemistry, electron microscopy, DNA flow cytometry, karyotype).

Optional features in diagnostic report

In many tumor types one or more of the features listed below may impact on either the likelihood of recurrence or the overall prognosis [6, 8]. Although mitotic rate and estimation of necrosis are key features of most grading systems, some pathologists may prefer to comment on them specifically in the final report.

1. Mitotic rate, expressed as number of mitoses per 10 high-power fields.

Note: While acknowledging that mitotic rates vary according to factors such as cellularity, section thickness, fixation and the type of microscope used, since there is no better or more reliable alternative the Association recommends that mitoses be counted using the ×40 objective and that mitoses be counted in the most proliferative area identified. Average counts over a larger area have no known significance in this specific context.

2. Extent of necrosis, as confirmed histologically.
3. Presence or absence of vascular invasion, irrespective of vessel type.
4. Character of lesional margin – e.g. circumscribed, focally infiltrative, diffusely infiltrative.
5. Presence, extent and type of inflammatory infiltrate.

Appendix 1. Classification of soft tissue sarcomas

Fibrous and myofibroblastic tumors
- Fibrosarcoma
  - Adult type
  - Infantile type
  - Inflammatory type (inflammatory myofibroblastic tumor)
  - Sclerosing epithelioid type
- Low-grade fibromyxoid sarcoma

Fibrohistiocytic tumors
- Dermatofibrosarcoma protuberans
  - Myxoid variant
  - Pigmented variant
  - Fibrosarcomatous variant
- Angiomatoid (malignant) fibrous histiocytoma
- Malignant fibrous histiocytoma
  - Pleomorphic/storiform variant
  - Myxoid variant (myxofibrosarcoma)
  - Giant cell variant
  - Inflammatory variant

Adipocytic tumors
- Liposarcoma
  - Well differentiated (atypical lipomatous tumor)

a) Lipoma-like variant
b) Sclerosing variant
c) Inflammatory variant
d) Spindle cell variant
  - Dedifferentiated
  - Myxoid/round cell
  - Pleomorphic

Smooth muscle tumors
Leiomyosarcoma
- Conventional
- Epithelioid

Skeletal muscle tumors
Rhabdomyosarcoma
- Embryonal
- Botryoid
- Spindle cell
- Alveolar
- Pleomorphic

Vascular tumors
Angiosarcoma (lymphangiosarcoma)
- Epithelioid variant

Kaposi's sarcoma
Epithelioid hemangioendothelioma

Perivascular tumors
Malignant glomus tumor
Malignant hemangiopericytoma

Synovial tumors
Malignant tenosynovial giant cell tumor

Neuroectodermal tumors
Malignant peripheral nerve sheath tumor
- With heterologous rhabdomyosarcoma (Triton tumor)
- With other mesenchymal heterology
- Epithelioid variant

Malignant granular cell tumor
Clear cell sarcoma (malignant melanoma of soft parts)
Malignant melanotic schwannoma
Malignant peripheral primitive neuroectodermal tumor (extraskeletal Ewing's sarcoma)

Extraskeletal chondro-osseous tumors
Extraskeletal myxoid chondrosarcoma
Extraskeletal mesenchymal chondrosarcoma
Extraskeletal osteosarcoma

Miscellaneous tumors
Alveolar soft part sarcoma
Epithelioid sarcoma
Synovial sarcoma
Desmoplastic small cell tumor
Ectomesenchymoma
Extrarenal rhabdoid tumor
Malignant mesenchymoma

Appendix 2. Checklist for use in diagnosis of soft tissue sarcoma

Tumor site (anatomical location)

Depth: Dermal
Subcutaneous
Subfascial
Intramuscular
Intra-abdominal
Retroperitoneal
Other (specify):

Note: More than one tissue plane may be involved and should be so indicated.

Type of resection: Excisional biopsy
Local excision/enucleation
Wide local excision
Compartmentectomy
Radical excision
Amputation (including type)
Other (e.g. piecemeal)

Histological type:
Tumor size:
Histologic grade:

Note: At least indicate low or high grade if applicable or grade according to the FNCLCC or NCI system.

Necrosis:
Absent or Present
Macroscopic or microscopic approx. extent __%

Status of margins:
Uninvolved
Closer than 2 cm *state which margin(s) and measured distance(s):*
Involved *state which margin(s):*

Results of ancillary/special studies:

Appendix 3. Guidelines for grading soft tissue sarcomas

Tumors which are high grade by definition
Ewing's sarcoma/MPNET
Rhabdomyosarcoma (except spindle cell variant)
Angiosarcoma
Pleomorphic liposarcoma
Soft tissue osteosarcoma
Mesenchymal chondrosarcoma
Desmoplastic small cell tumor
Extrarenal rhabdoid tumor

Tumors which are low grade by definition
Well-differentiated liposarcoma/ atypical lipomatous tumor
Dermatofibrosarcoma protuberans
Infantile fibrosarcoma
Angiomatoid "MFH"

Tumors which are not gradable but which often metastasize within 10–20 years of follow-up
Alveolar soft part sarcoma
Clear cell sarcoma
Epithelioid sarcoma
Synovial sarcoma
"Low-grade"' fibromyxoid sarcoma

Tumors of varying behavior for which grading may be prognostically useful
Myxoid liposarcoma
Leiomyosarcoma
Malignant peripheral nerve sheath tumor

Fibrosarcoma
Myxofibrosarcoma (myxoid MFH)
Pleomorphic “MFH” (so-called)[1]

Tumors of varying behavior for which grading parameters not yet established
Hemangiopericytoma
Synovial sarcoma
Myxoid chondrosarcoma
Malignant granular cell tumor
Malignant mesenchymoma

[1] Lesions labeled as pleomorphic “MFH” can only be graded if non-sarcomatous mimics with similar morphology have been excluded first.

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