Identifying and Describing Pathological Conditions, Lesions, and Anomalies

1.0 Principle, Spirit, and Intent

Skeletal material and documentation should be examined in a systematic manner for the purpose of identifying, describing, and documenting pathological conditions, lesions, and anomalies that may be relevant to the identification of unknown individuals, life history, and/or the circumstances surrounding death. The examination should be performed in a manner that facilitates the development of a differential diagnosis as well as the independent replication and verification of the work performed and the conclusions drawn.

2.0 Purpose and Scope

These guidelines outline acceptable practices for describing, documenting, evaluating and reporting pathological conditions, lesions and anomalies in bones and teeth. Practitioners of forensic anthropology should implement these guidelines to the fullest extent as applicable, practical, and appropriate. In the absence of specific guidelines, or in the case of conflicting procedures, the principle, spirit and intent should be met.

3.0 General Principles

The pathological conditions, lesions, and anomalies detailed in these guidelines are the result of antemortem processes. The description and documentation of these conditions in the human skeleton can be extremely useful in helping to develop a presumptive identification and/or confirm the identity of unknown remains. The interpretation of observations of this type merits a cautious approach as the degree and type of bone response to various pathological conditions and lesions often overlap, particularly in infectious, metabolic, and neoplastic disease.

Identification of pathological conditions, lesions, and anomalies should only be as specific as can reasonably be determined by a careful differential diagnosis. Evaluation of some conditions, such as biomechanically related changes to bone originating from degenerative joint disease might only require macroscopic observations. Other cases such as infectious, metabolic, neoplastic, and other complex designations may need to meet more specific criteria that can be better assessed through other modalities, such as imaging, histology, and microscopy.

A detailed description (to include a graphic representation of the patterning and distribution) of observed conditions and their distribution throughout the skeleton may be sufficient when a differential diagnosis cannot be made.

Because the subject of pathological conditions, lesions, and anomalies is diverse and complex, a comprehensive and specific discussion of methods and literature is beyond the scope of these guidelines. Rather, the anthropologist working within this area is expected to consult the relevant literature, much of it clinically based, in accordance with the observations at hand.

3.1 Pathological Conditions and Lesions

As often used in anthropology and medicine, a pathological condition represents an abnormal change in the normal anatomy, often the result of a disease, as recognized grossly, radiographically, or histologically. Common types of pathological conditions and lesions that may be diagnosed include:

- Chronic infectious disease (e.g., tuberculosis, osteomyelitis).
- Metabolic disorders (e.g., porotic hyperostosis, osteoporosis).
- Neoplastic diseases (e.g., tumors).
- Congenital anomalies (e.g., spina bifida).
- Vascular/circulatory (e.g., aneurysm).
- Degenerative joint disease (e.g., osteoarthritis).
- Calcified arterial plaque, cartilage, or other soft tissue.
- Autoimmune diseases (e.g., rheumatoid or psoriatic arthritis).
- Trauma (e.g., healed or healing fracture).

3.2 Anomalies

Anomalies are recognized skeletal variants and are usually congenital or epigenetic in origin. They may or may not have clinical significance.

Examples include:

- Accessory bones (e.g., wormian bones, *Os japonicum*).
- Bipartite bones (e.g., bipartite patella).
- Sternal, septal, and other apertures.
- Bifid and/or supernumerary ribs.
- Vertebral shifts and other axial anomalies.
- Prominent features (e.g., everted gonia, bilobed chin, unusually large or small facial features).
- Cranial asymmetry not attributed to cultural modification (e.g., scaphocephaly).
- Dental anomalies (e.g., supernumerary teeth, extra roots, dental agenesis).
- Polydactyly.

4.0 Best Practices

Where possible, pathological conditions, lesions, and anomalies should be assessed in comparison with standard examplars and models derived from documented clinical and research

cases with comparable diagnostic criteria. Exemplars may consist of anatomical sets, individual specimens, casts, reproductions, and medical/clinical or anthropological literature.

Interpretations of pathological conditions and lesions should be supported by documented clinical and forensic case studies and literature that provide sufficiently detailed observations.

Forensic anthropologists should:

- Record, document, and describe all observations of pathological conditions, lesions and anomalies in osseous and dental remains. Bench notes, supplemented with written diagrams, sketches, photographs (and other imaging modalities, when appropriate), are best used to describe and evaluate pathological conditions, lesions and anomalies. Terminology should be consistent throughout.
- Report only supportable conclusions based on a reasonable interpretation of all available data.
- Present all reasonable interpretations (e.g., "… given the remains present, the advanced nasal destruction could be a manifestation of tertiary yaws, advanced syphilis, or leprosy").

4.1 Description and Differential Diagnosis

The following section offers guidance and methodology for developing a differential diagnosis from osseous and dental remains.

Rather than being an outcome or a result, differential diagnosis is a process of elimination that narrows the field of possible conditions. When a diagnosis cannot be made, a description of the observed features and pattern of distribution is sufficient.

Depending on the nature of the remains (e.g., completeness, preservation) not all steps in the differential diagnosis process may be feasible and/or they may only progress to a certain stage in the process. If a definitive conclusion or diagnosis is not forthcoming, equivocal results should be reported as such.

Upon recognition of a pathological condition, lesion, or anomaly, the anthropologist should describe, document, and attempt to identify what is observed using the process of differential diagnosis. The process of differential diagnosis may not result in a single diagnosis but a list of likely conditions. Regardless, description and documentation are the most important steps in the differential diagnosis. The observations should be completely described and documented using a combination of text, photographs, diagrams, radiographs (or other imaging modalities), and sketches. Other anthropologists should be able to visualize the condition on the bone based on the written description from the notes.

4.2 Guide to Differential Diagnosis

Clearly describe skeletal conditions in case documentation using accepted anatomical terminology. For example, lesions may be described or classified as lytic, proliferative, a combination of both, or deformative. Other considerations in descriptions of conditions include:

- Overall shape and size.
- Extent of the bone involved (describe anatomically, e.g., distal third of shaft).
- Distribution on the bone (discrete, multifocal, diffuse, circumferential, etc.).
- Characteristics of the edges, walls, and floor (blunt, sharp, regular, irregular, etc.).
- Type of proliferative bone (compact, pitted, porous, loosely woven), if present.
- Remodeling of bone.
- Extent and progress of healing, if present.
- Presence of accompanying features (cloacae, sequestrae, periostitis).

If the bone is damaged, where possible, describe the condition of the bone layers in cross section.

Describe the condition of the remainder of the bone including the articular surface (e.g., eburnation on an adjacent articular surface).

Describe the adjacent bones (e.g., infection spread from the radial shaft to the interosseous crest of the ulna), to include articular surfaces.

If paired, compare the altered bone to its antimere, and note atrophy, deformation, rarification, thickening, etc.

Describe other related pathological conditions and lesions in the remainder of the skeleton. Some conditions (e.g., treponemal) are diagnosed based on overall lesion distribution patterns in the skeleton.

If possible, describe the distribution of similar conditions, lesions, or anomalies in the population. Clinical literature can be consulted as to frequencies in various populations. If two or more conditions are suspected, list all possibilities and state which of them is more probable. This probability should be based on the literature and knowledge of the presumptive population.

Consider that an individual may exhibit more than one condition concurrently. If there are ambiguous or conflicting criteria, they may represent two or more diseases.

Conduct appropriate research using the clinical and anthropological literature, since many alternative diagnoses may not be obvious.

When available, consider previously diagnosed conditions documented in the medical record.

5.0 **Additional Considerations**

5.1 Pseudopathology

Pseudopathology is a skeletal change or artifact that may mimic and be mistaken for a pathological condition or lesion during the process of differential diagnosis; it should be described and photographed and clearly distinguished from a *bona fide* condition. For example, taphonomic alterations like rodent gnawing or insect damage are sometimes mistaken for pathological conditions and lesions on bones. Cultural modifications may also be similarly misinterpreted.

5.2 Secular, Temporal, and Geographical Considerations

Given changes in the standard of living, access to and advances in medical care, and improved nutrition over the past 100 years, many chronic and acute conditions that once affected the human skeleton are now less common. Consequently, the presence of some conditions (e.g., chronic osteomyelitis) may be of value in differentiating more modern forensic cases from ancient or historic remains, or distinguishing remains of individuals with limited, or no, access to medical treatment.

Some pathological conditions, lesions and anomalies may suggest a regional origin for the remains, or reinforce previous population-based determinations (e.g., gout in adolescent Pacific Islanders).

5.3 Occupational Markers

Stresses and strain on an area of the skeleton over time may cause the skeleton to respond or adapt to these forces. The most common indicators of these types of changes are occupational markers. Occupational markers represent the cumulative effects on bone from repetitive activity over time (e.g., from occupational or recreational activity) that may alter the skeleton in the form of hyper-developed tubercles, crests, processes, and fossae; bowing or other changes in the diaphyses; facets; degenerative changes; or lesions. Often, in paired bones, asymmetry in robusticity, length, shape, and density may be indicative of such activity. Exposure to certain chemicals may alter bone response and quality. Facets, grooves, notches, fractures with worn surfaces, premature wear, and lesions may be apparent in the dentition.

6.0 Unacceptable Practices

The following practices are considered unacceptable and should be avoided when identifying and describing pathological conditions, lesions, and anomalies:

- Reporting unsupportable results, over-reaching in interpretation, or too narrowly interpreting observations.
- Reaching a differential diagnosis with inadequate descriptions or documentation.
- Reaching an immediate conclusion without undertaking a differential diagnosis.
- Failing to employ imaging modalities when appropriate.