

Palaeopathology

Tony Waldron

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The challenge of the paleopathologist is to provide parallels between the skeletal lesions on human and/or hominin remains to diseases and symptoms found within modern clinical data. Clinical data often is used within paleopathology to explain periosteal reactions to disease pattern processes. For the most part, ancient and modern diseases follow the same patterns and are easily interpreted. For example, osteoarthritis in modern populations has similar bony changes to those found within human skeletal remains. Other diseases such as tuberculosis and syphilis, however, are more difficult to diagnose in past skeletal populations because the periosteal reactions are truncated through antibiotic use within the modern clinical data sets. In order to navigate through modern clinical symptoms and past skeletal diseases, Waldron brings an abundance of anatomy, physiology, immunology, and osteology into his book *Palaeopathology*. As a textbook, this book would be best suited for advanced undergraduates and/or a professional audience who is already familiar with the topics above. Most importantly, this book is small, covers a variety of paleopathological lesions, and could be easily transported as a reference text into the field or museum.

Reconstructing past diseases from skeletal remains presents more challenges than diagnosing illness among living people. Skeletons cannot speak for themselves and verbalize what hurts or feels bad. In addition, the soft tissue that has most of the lesions is usually missing. Bones only retain the illnesses that have persisted for a long enough time to spread into the skeleton and change its bony structure. The researcher, therefore, has to examine all of the bones present because of the different types of data that are present. A differential diagnosis is made because each bone may have a different type of lesion that could be a symptom of more than one disease. By making a list of the diseases, the disease that has the most symptoms present on the skeleton becomes the most likely pathogen, but one that cannot rule out the other possible disease choices.

Waldron begins with an explanation of differential diagnosis that is used to identify pathologies in human skeletal remains. He recognizes challenges in reconstructing past diseases in skeletal samples due to small sample sizes, applying clinical criteria to skeletal data, and differential rates of secondary osteon formation. He walks the reader through diseases by type, examples of which are joint, infectious, metabolic, soft tissue, and dental diseases. Other

aspects of paleopathology that he includes are trauma, growth disorders, developmental defects, and an introduction to epidemiology. In short, Waldron covers a variety of topics and provides well rounded introductory descriptions of common paleopathological lesions found in the human skeletal record.

While Waldron summarizes disease symptoms and clinical vs. skeletal diagnostic criteria in easy to read tables, there are a few points that would need to be resolved in order to market this book to average anthropology majors. While the book is not written as a photographic atlas, it would be more helpful to students to have more pictures of bone elements and their features with an accompanying summary or overview. The more advanced researcher, moreover, would be able to use the pictures as visual reminders of skeletal lesions while in the field. In addition, students will probably look to the back of the book for a glossary, but researchers will not need one. A glossary would be particularly helpful because the definitions of diseases in skeletal material are not the same as those found in the clinical literature. While the definitions are similar, a student may not know how to translate those into skeletal elements and into paleopathology as fluidly as a researcher.

Chapter Two, bone metabolism and pathology, further demonstrates to the reader that Waldron has an excellent knowledge base of physiology and immunology. Undergraduate osteology students most likely will need help to understand some sections of the text, but advanced readers should not. Waldron masterfully describes cytokines and their complex relationships with osteoblasts, osteocytes, and osteoclasts. This is a more in-depth description of bone remodeling than in other texts, but it gives the reader a taste of the specificity of his knowledge base. In other words, professors will want to read up on interleukins (specifically IL-1, IL-4, IL-6, IL-10, IL-11 and IL-13), cytokines, and the parathyroid glands' positive and negative feedback systems before lecturing on this topic. The advanced reader who navigates this text will appreciate that bone formation is more complicated than it seems on the surface and will know where to look for further descriptions of physiological processes due to the helpful footnotes on each page. In contrast, the average anthropology major may want a little more discussion of endochondral versus intramembraneous ossification and the differences between primary and secondary osteon formations before adding all of the cyto-

kines into the mix.

In order to distinguish between the proliferative and erosive joint diseases, Waldron divides joint diseases into Chapters Three and Four. Osteoarthritis, the main focus of Chapter Three, is described in great detail, including a natural history, diagnoses, and commonly affected areas on the skeleton. Chapter Four introduces the erosive diseases, which are mostly caused by autoimmune problems. These include, but are not limited to, erosive osteoarthritis, rheumatoid arthritis, seronegative arthropathies, and gout. Each of these paleopathologies has a diagnostic photo (of one bone element each) and an operational definition box. The boxes have the classic symptoms for each bone disease as well as descriptive conjunctions (and, with, or) to help the reader conceptualize differences between each disease. Chapter Five completes the bone change section by describing other additive and reduction of periosteal reactions that transcend multiple skeletal elements. These include DISH (in which the anterior longitudinal ligament of the spine ossifies and attaches to multiple vertebrae) and hypertrophy of bone elements due to injury or disuse.

Waldron's infectious disease chapter covers nonspecific and specific infections including osteomyelitis, tuberculosis, and syphilis. Each of these is presented with the different infectious agents (bacterial or viral) and a summary of bony changes due to each of these diseases. Waldron includes a taste of the natural histories of tuberculosis, syphilis, and leprosy, but as with all of his chapters, more detailed information can be found in his extensive footnotes throughout the text.

In Chapter Seven, metabolic diseases (those caused by hormonal imbalances or other disturbances of the metabolism), are described as systemic diseases. Each of these diseases affects multiple locations of the body and are reflected in more than one bone element. These diseases, therefore, are more difficult to pinpoint within the skeleton because of the greater number of factors that affect the growth and development of the disease itself and its manifestations within the skeletal elements. This section has more tables, models of etiology (or flow charts), and operational definitions alongside suggestions that the researcher use conservative diagnostic criteria in identifying these pathologies.

Traumas (Chapter Eight), on the other hand, are more limited to affecting only one bone. For example, individuals usually break the right or left arm and it is rare that they are both broken at the same time. Waldron explains there are two types of trauma: accidental and deliberate, as well as multiple types of resulting fractures. For example, greenstick fractures are more likely to be found in children and parry fractures are likely to be found in individuals who are fending off an attack by raising their arm to protect the head. He returns to bone remodeling processes briefly to explain bone fracture healing processes. More importantly, he includes older types of wounds, such as trephination and fractures, alongside more modern wounds, such as gunshots and cut patterns specific to autopsies. The pictures and descriptions associated with these different types of trauma will enable the undergraduate and researcher to

recognize these different types of trauma within their own project.

Chapter Nine concerns tumors, which while they usually affect only one skeletal element at a time, are more difficult to assess because of the variety of cancer types. Even though paleopathologists are limited to the skeletal tissues, the tumors found could have originated from bone, cartilage, bone cysts, and other tissues. This means that the individual may have had cancer that originated within the soft tissue and traveled into the bone as it traveled throughout the body. This makes it more challenging to identify the specific type of cancer involved and what the effects it would have had on the individual during his or her lifetime. In addition, there are many types of bone tumors that look similar to each other and could easily be confused. Given these challenges, Waldron provides an excellent introduction to the topic, but his description is by no means exhaustive.

Disorders of growth and development (Chapter Ten), Waldron argues, is where the skeleton provides the best data. Even though a population shares the same genetic material, individuals achieve differing heights because of nutrition and the amount of each hormone expelled within the blood stream. Poor nutrition decreases the growth rates of both children and adolescents because they need appropriate levels of calcium, phosphorus, iron, copper, and zinc in order to reach their maximum heights. Hormone deficiencies reduce the growth rate because they are needed to initiate bone deposition. Other changes in the amounts and types of hormones will result in skeletons that are notably shorter, taller, and/or have bones that have different shapes than normal. These differences usually follow patterns which the researcher and student will be able to identify. Some of the pathologies that Waldron covers include dwarfism, gigantism, cleft palates, fibrous dysplasia, and scoliosis.

Soft tissue diseases are important to paleopathologists because some infectious diseases begin within the soft tissue and travel to hard tissue (bone). The soft tissue diseases discussed in Chapter Eleven are particularly relevant to mummy research. Most modern mummy studies include CT or MRIs which can create images of the internal organs and tissues without destroying the mummy itself. There are not as many images within this chapter perhaps because they are readily available within the clinical literature. Waldron includes descriptions and definitions of aneurysms, neural lesions (meningioma, neurofibromatosis), stones, and cysts. These soft tissue diseases are not the main focus of his book and as such do not receive as much attention as other chapters.

Dental disease (Chapter Twelve) is an important indicator of overall health of the individual. Deciduous teeth begin to form in the womb and complete ossification after birth. These can provide information about the health of the pregnant mother, infant, and weaning toddler. Adult teeth start to form in childhood and complete growth in adolescence thereby providing information about childhood health. Waldron focuses his chapter on the infectious

diseases of the teeth. He includes ante-mortem tooth loss, periodontal disease, caries, and developmental defects of enamel. As with other chapters, Waldron includes enough of a description of the cellular processes alongside a description of physical symptoms. It is a short, but dense description of the paleopathologies, but his detailed footnotes assist readers of all levels to find more information elsewhere.

Waldron concludes with a chapter on epidemiology in order to help the reader analyze and share paleopathological data within anthropology and with other disciplines. He explains basic statistics vocabulary and how to interpret its comparisons of skeletal data to other skeletal and living populations. Skeletal populations present different challenges than living populations because the sample sizes are always smaller. There is always a chance that the skeletons recovered and analyzed are not a true representation of the population itself, but Waldron gives different explanations of how to best use the data that is available. An example that he gives is to limit the number of skeletons that are in-

cluded within the study to those that are the most intact. If the researcher examines osteoarthritis in femora, he or she should include femora that have intact tibial articular processes and exclude those that do not have a complete knee surface. Selective, small sample sizes eliminate possible error in data analysis. For example, a femur with a missing knee joint should not be included in the sample because that missing joint could have osteoarthritis. It is better to remove that femur from data analysis instead of including it within the category of femora that have no osteoarthritis.

Waldron provides an excellent overview of disease processes that are present within the human skeletal paleopathological literature. Each chapter represents a different disease process that bridges the clinical and paleopathology data and includes operational definitions, tables/figures, and footnotes of other relevant sources. Researchers will want to use this text in the field, to introduce advanced undergraduates to the sub-discipline, and as a starting point for bridging anthropological and clinical data within their own research projects.