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PRINCIPLES OF REPORTING POST-MORTEM FINDINGS

by
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Bioenvironmental Research
Southwestern Radiological Health Laboratory

Department of Health, Education, and Welfare
U. S. Public Health Service
National Center for Radiological Health

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This study performed under a Memorandum of
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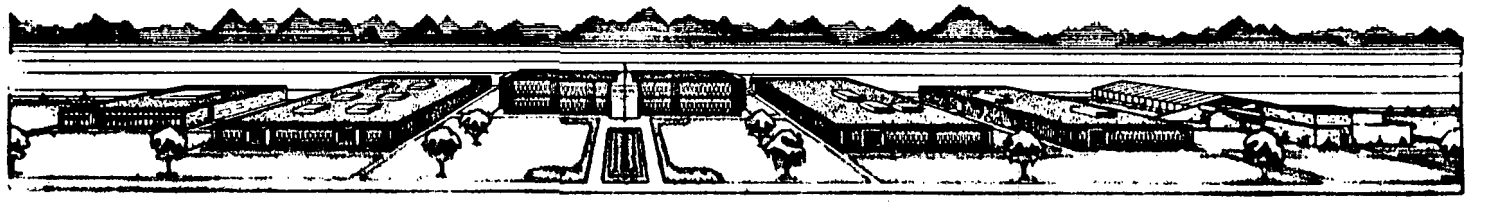

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PREFACE

This report was felt to be necessary because biologists, veterinarians, physiologists, etc., for the most part, are not well trained in describing the post-mortem observations made on animals, whether wildlife or domestic. By distributing this report on a wide scale, it is hoped that investigations will be of more value, since the report will incorporate more meaningful descriptions of the post-mortem findings. Although the principles of post-mortem reporting are somewhat standardized in the medical disciplines, the average biologist is usually not aware of the established standards. Unfortunately, in dealing with descriptions of lesions, the impressions of the observer lend more subjectivity to the report than one desires. Nevertheless, for most applications adequate detailed descriptions of lesions will result if the observer follows the outline given in this report.

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INTRODUCTION

Pathology is defined as that branch of biological science which deals with the nature of disease, the study of its cause(s), its process, and its effect(s) together with the associated alterations of structure and function.[1]

A study in determining the nature of pathological lesions in biological specimens must include data that are complete, descriptive, and accurate. It is usually necessary to standardize certain phrases and common descriptive words used in pathological anatomy. A standardized method of preservation for the pathology laboratory should also be adopted. A need for a modern guide for the performance of post-mortem descriptions was readily apparent while searching the files of various sources for necropsy reports on wildlife and domestic animals. Many excellent cases were unsuitable for inclusion in the survey for common and obscure pathological lesions in the desert bighorn sheep and beef cattle. In the vast majority of cases, lack of essential data and inadequate or poorly prepared tissue resulted in a statement by the pathologist, such as "extensive post-mortem autolysis" or "inadequate information for positive pathological diagnosis."

This report will be limited to proper preparation of necropsy protocols, terms used for describing various lesions, and methods of preserving biological material for the pathologist. Excerpts from necropsy reports on two desert bighorn sheep will be described using these terms to demonstrate the usefulness and importance of utilizing descriptions that are meaningful to the pathologist.

OBJECTIVE OF PROTOCOL

The necropsy protocol serves as a precise word picture of all observations made during the post-mortem examination. It is not suggested that the protocol be rigidly stylized; however, it should be kept in mind that if an acute observation is made and it is not recorded properly, it then becomes of little use to the investigator.

The objectives for well-written, accurate protocols are:

a. To act as a stimulant and adjuvant to the investigator in order to facilitate correlation of field and post-mortem observations.
b. To be a reliable method of preserving information for reports of individual field cases.
c. To serve as an accurate record of facts whenever legal action is anticipated.
d. To serve as essential information which will enable the pathologist to make an interpretation of histological findings.

A special form is not necessarily required although it is a tremendous aid to the proper recording of necropsies. Various types of protocol forms have been described; all have their advantages and disadvantages. Regardless of the type of protocol form decided upon by the investigator, it should include essential facts, such as time and date of necropsy, species, sex, age, time of death, and field or clinical history.

Mc. T. Cowan has described post-mortem procedures for wildlife biologists stressing methods as well as observations which are of importance in describing the field or clinical history.[3] It is recommended that personnel doing the necropsy become familiar with the proper necropsy procedures,[3] tissue preparation,[4] and methods of recording the observations of lesions and organs using acceptable pathological anatomical terminology. Hereafter in this report, any nonpathologist performing necropsy procedures will be referred to as a prosector realizing that the definition is not complete in its entirety.

BASIC DESCRIPTIVE WRITING

As in any descriptive writing, the prosector should be objective. He should write down what he actually observes, not opinions or impressions. His interpretations may be summarized and expressed as a diagnosis. However, it is not proper to include these in a lesion or organ description. Ten items or salient features of a lesion or organ are usually necessary to fully describe the true observation.[2] Not all items are applicable in every instance; nevertheless, an attempt to include all items is important. The description of a lesion or organ should include:

a. Position. The relation and orientation of the lesion to other organs and structures should be stated as well as the presence of adhesions.

b. Size. Measurements should be taken in all dimensions as accurately as possible. Use of the metric system is suggested. Whenever measurements are not possible, approximations should be made.

c. Weight. In the field, accurate measurements of weight are usually not possible. If scales are not available, an attempt at an estimated weight should be made.

d. Color. Tone, shade, and distribution of color should be described. If the prosector is color blind, describing contrasts between the abnormal and normal in many cases will aid in the description.

e. Consistency and texture. These features are subjective, depending on the skill and training of the prosector. Whenever possible the lesion or organ should be palpated by placing it between thumb and fingers or both hands under various configurations. However, the specimen should not be squeezed.

f. Odor. This is another subjective judgment which requires experience in determining significant and distinctive odors of tissues and contents of lesions, hollow organs or structures. Many

infectious agents cause a characteristic odor in the affected tissue or organ.

g. Cut surface. For adequate description of any lesion or organ, a cut surface should be exposed, especially for such organs as liver, spleen, and kidney. Description should be made immediately. The surface should not be allowed to dry.

h. Shape. The shape or lack of shape should be reported. Accurate determination of the outline and configuration is sometimes of importance.

i. Contents. The quantity, color, and consistency of the contents of such structures as the pleural sacs, gastrointestinal tract, gall bladder, urinary bladder, abdominal and pericardial cavities should be recorded.

j. Lumen of tubular organs. Any abnormality that affects the function should be described. This will include dilation, stricture, hypertrophy, atrophy, or any other condition that is of significance.

Only slight mention of normal anatomical relationships is made in these 10 items; however, to properly describe the location of the lesion or organ, more detailed anatomical terms must be known. Admittedly, it is well to have knowledge of all, but this is not necessary. To present a "word picture" to the pathologist, the prosector should be acquainted with the following terms and their definitions as applied to pathological anatomy. In the explanation of these terms, it is assumed here that they apply to a quadruped, such as the sheep in a normal stance. The surface directed toward the plane of support (the ground) is termed ventral; and the opposite surface is dorsal, i.e., the top of the animal. The relation of parts in this direction are named accordingly. The longitudinal median plane divides the body into similar halves. Structure B, which is nearer than structure A to the median plane, is said to be medial to A. Conversely structure B, which is further than structure A from the median plane, is said to be lateral to A. Planes parallel to the median plane are termed sagittal planes. The head end of the body is termed

cranial, rostral, or cephalad; and the tail end is termed caudal; relations of structures with regard to the longitudinal axis of the body are designated accordingly. Certain terms are used in a special sense as applied to the limbs. Proximal and distal express relative distances of parts from the attachment to the body; e.g., the head of the femur is proximal to the stifle (knee joint). The terms superficial and deep are useful in determining the distances from the surface of the body. Oblique is a useful term to indicate neither lateral, medial, ventral, nor dorsal. It is a plane of that portion of the body not perpendicular to any of the three axes of the body.

Pinpointing an anatomical area or a lesion within this area requires further refinement. Many times it is necessary to measure exactly the extent of the lesion and its relationship to another organ. In those cases where it is either impossible or impractical to measure the extent of the lesion, a reasonable estimate should be made. Practically speaking, mentally dividing the organs into thirds usually suffices, although halves or quarters may be more explanatory. If a lesion falls in an area where it may be termed a junction, it is proper to say that such a lesion, for example, is located at the junction of the distal one-third and middle one-third. An example of how these terms are applied to locating a lesion is a case history where a deer was shot by a hunter. On opening the thoracic cavity, the hunter noticed large red areas in all lobes of the right lung. An examination was made by a technician in which tissue was taken and sent to a pathologist. The lesion was located schematically in Figure 1.

The description should read as follows: Dark red, well-demarcated, firm areas are noted in the entire ventral one-half of each lobe of the right lung. A similar area is observed in the cranial dorsal one-third of the right apical lobe.

This clearly indicates a lobar distribution in the lungs, therefore leading the pathologist to look for a systemic disease rather than an isolated source. Proper description of the location of dissemination lesions will,

in many cases, be enough information for the pathologist to arrive at a correct diagnosis. Further histological and laboratory studies will confirm his diagnosis.

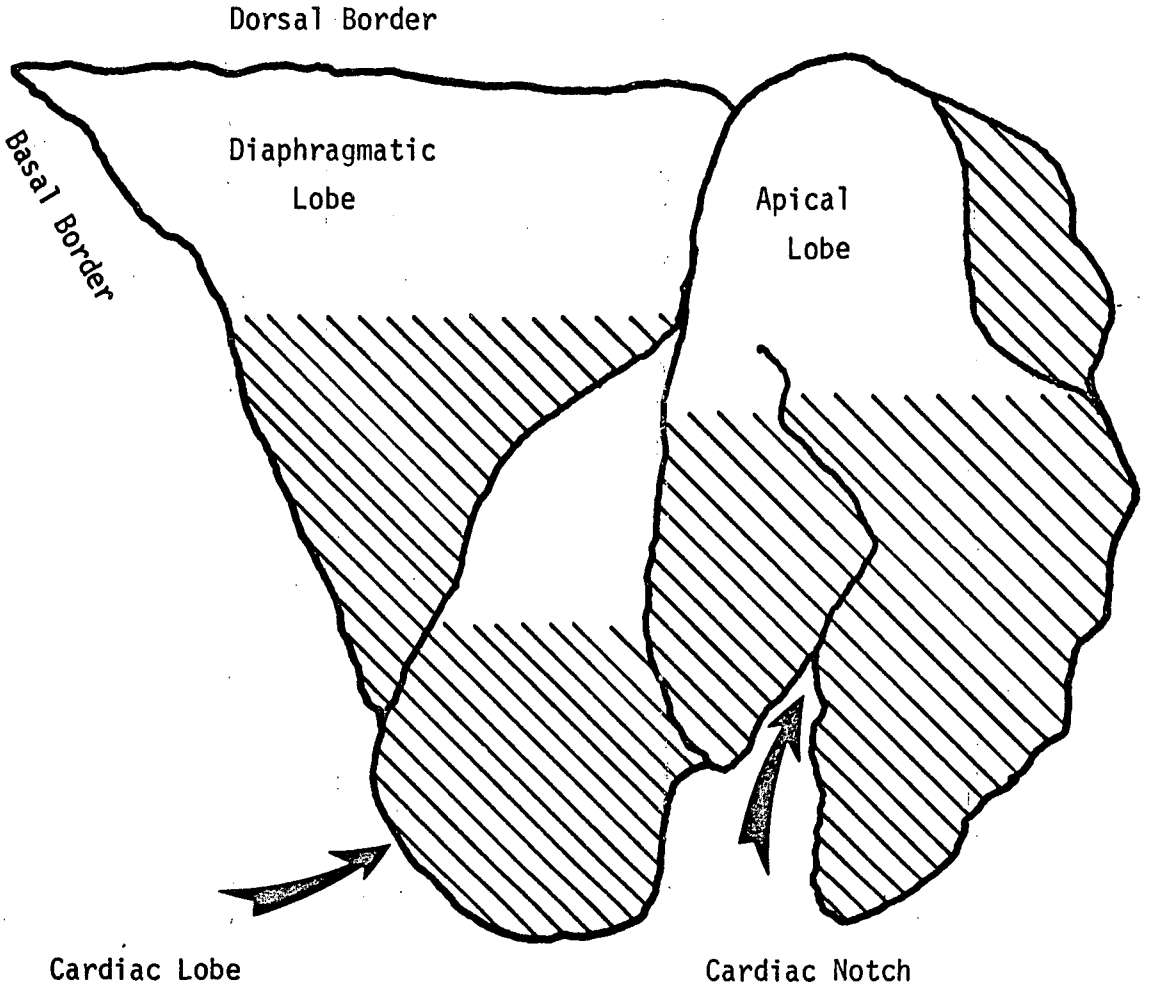

Figure 1. Schematic drawing of right lung showing areas of involvement.

It is the responsibility of the prosector, whether wildlife technician, research biologist, or veterinarian, to describe what is observed during a post-mortem examination. The use of terms given in this report will enhance a systematic approach to the necropsy which will decrease the chances of overlooking lesions or abnormal organs. An accurate description of the gross observations may be decisive in establishing a diagnosis or in determining the relative importance of lesions.

Tissues that are taken during the course of the necropsy and removed for microscopic examination should not measure any greater than 5 mm in thickness and should be less than 2 cm in any dimension. It is important that the thickness be not too great so that proper fixation will occur and maximum benefit will be obtained. Special care must be taken with any tissues containing a large amount of blood, such as spleen and bone marrow. The structures must be kept extremely thin because fixation of such tissue is extremely slow and penetration may not occur until autolysis has destroyed the morphology, thus rendering the tissues of no diagnostic use.

Normally, all tissues that are taken should be fixed in buffered formalin. The volume of the fixative must be at least 10 times the volume of the tissue sample. In this respect, it is better to have too small a tissue sample than a tissue sample that is too large for the volume of fixative in which the tissue is being preserved. The first phase of fixation is the rapid killing of tissue. Rapid killing of all the tissue sample can only occur if the slice of tissue is capable of being penetrated by the fixative. The tissue should be placed in the fixative immediately upon removal from the body to preserve the relation of the tissue elements as they were in life. The second phase, or the hardening process, should be of such degree that the normal tissue components will not be adversely affected by any subsequent procedures. For the most part, buffered formalin is used because it kills tissue rapidly, hardens tissue, and is compatible with most stains. The length of fixation depends on the size of a block; however, if the recommended size of blocks is used, overnight fixation will result in adequate

killing and hardening of the tissue. If several special stains are required, small blocks of tissue should be fixed in the appropriate fixative as suggested by Mosby and Mc. T. Cowan.[4]

Tissue specimens to be sent to the pathology laboratory should be packed in heavy plastic bags. This assures safe arrival of the tissue specimens and provides ease of handling and storage. The tissue should be wrapped in gauze or placed in a cotton bag. Before heat sealing, excess fixative should be decanted leaving a sufficient amount only to saturate the gauze wrapper or cotton bag. Special attention is required for handling bone specimens, as sharp edges may rupture plastics if such specimens are not properly padded with either extra cotton or gauze. Identification containing information as to species, date, necropsy number, and contributors should be sealed in a separate upper portion of the plastic bag. A complete, detailed necropsy protocol should accompany the tissue and be addressed to the pathologist.

Excerpts from two different necropsies of desert bighorn sheep will be used to illustrate how much pathological anatomy can be written in a necropsy protocol by biologists who used the rough draft of this report for a guideline.

Case 1: General Examination

The body is that of a 14-year-old, male desert bighorn sheep that has been dead approximately 14 hours. The body is in a state of poor nutrition. There is a full set of incisors; however, a very offensive odor is emitting from the oral cavity. A screw worm larva is found in the left conjunctival sac and in the mouth amongst the debris stuck between the right upper and lower molars. The middle one-third of the right horn shows a marked degree of decomposition. The horny material is black and in many portions infested with screw worm larvae. The center of the horn, which is normally honeycombed, is filled

with light yellowish purulent material. This extends into the sinuses of the right side of the skull. The condition is manifested by very thickened, gray-colored sinusoidal membranes. The greatest extent of sinus involvement appears to be in the dorsal lateral portion of the right side. There is no involvement of the inner calvaria nor is there evidence of inflammatory changes in the meninges.

Respiratory Tract

There are extensive adhesions of the right cardiac and apical lobes to the right thoracic cage. The visceral pleural surfaces of these two lobes are involved. The adhesions are estimated to be at least 2 weeks of age. There is marked pulmonary edema in the dorsal portion of the left diaphragmatic lobe manifested as a diffuse light purple color, noncrepitant, moist lung parenchyma and reddish frothy fluid in the bronchi. The remaining portions of the lungs are pink, crepitant, and well filled with air.

Case 2: General Examination

The body is that of a 15-year-old, male desert bighorn sheep in fair condition. The animal has been dead approximately 24 hours. There is a subcutaneous abscess approximately 2 cm in diameter on the very ventral portion of the neck at the junction of the cranial and middle one-third. On cross section, the abscess is shown to have a capsule approximately 4 mm in thickness and to contain pale yellow, thick purulent material. There are two similar-type abscesses on the left hemisphere of the anus. Each has an approximate diameter of 3 cm and a 4-mm-thick capsule. Both contain a light yellow purulent material that is of a cottage cheese consistency.

Respiratory Tract

Extensive pleural adhesions of the right cardiac and apical lobes to the right thoracic cage are noted. These adhesions

are infiltrated with a yellowish gelatinous material and are estimated to be 3 to 8 days of age. Both lungs show extensive post-mortem changes; all lobes of the right lung are filled with edematous fluid and are noncrepitant and purplish in color. Vegetative material is noted in the lumen of all major bronchi of both lungs.

These two cases have been presented to show that the proper terminology and descriptive writing need not be confined to the experienced pathologist. The use of this report as a handbook to establish guidelines and aid in obtaining clearly descriptive words should be obvious. If one takes full advantage of the details and methods, one will vastly add to his knowledge. With proper tissue fixation and a proper description of the observations, the pathologist will be able to express his opinion in regard to the histopathology with more confidence which will result in more meaning to the investigator who did the post-mortem examination. The inclusion of such information in reports and other documents will be of value not only to the investigator and his agency but to others who use these reports in search of definite and definitive pathology of wildlife and domestic animals.

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NECROPSY FIELD KIT
(Minimum List)

1. Pair of rubber gloves.
2. Two knives (for skinning and boning).
3. A pair of scissors with one blunt and one pointed blade. The blades should be about 6 inches long.
4. Thumb forceps (rat tooth).
5. Dehorning saw (used for sawing bone).
6. Scalpel handle and blades (#22).
7. Buffered formalin.
8. Containers which are leakproof.
   a. Hard plastic containers with lids or mason jars.
   b. Heavy plastic bags.
   c. Gauze--4" squares for wrapping the tissue samples before being placed in fixative.
9. Labels:
   a. should be waterproof.
   b. both paste on and tie-on.
10. Camera (35 mm with close-up lens).
11. Scale which reads in grams.
12. Steel and sharpening stone.
13. Cutting board (8" x 12").
14. Paper towels.
15. Protocol sheets and two pencils.

GLOSSARY

1. atrophy: a shrinking, or wasting away, of an organ or tissue to less than its former and less than its normal size.

2. autolysis: spontaneous post-mortem dissolution or partial destruction of cells or tissues and organs as a result of enzymes elaborated in those sites during life.

3. bulbous: bulb shaped.

4. calvaria: the upper, domelike portion of the skull.

5. caseous: degenerative tissue which is dry, crumbly, and cheeselike.

6. conjunctiva: the mucous membrane covering the anterior surface of the eyeball and lining the inner surface of the eyelids.

7. crepitant: crackling; the sensation imparted to the palpating finger by gas or air in the subcutaneous tissues.

8. dilation: enlargement of a cavity, canal, blood vessel, or opening; occurring physiologically, pathologically, or made artificially.

9. discoid: shaped like a disk.

10. edema: an abnormal accumulation of fluid in cells, tissues, or cavities of the body, resulting in swelling.

11. exudate: a fluid, often coagulable, or formed elements of the blood, extravasated into the tissues or any cavity.

12. filiform: having the form of a thread or filament.

13. friable: easily crumbled or crushed into powder.

14. fungoid: resembling a fungus; denoting an exuberant morbid growth on the surface of the body.

15. gelatinous: like gelatin or jelly; having the consistency of gelatin or jelly.

16. hypertrophy: an abnormal increase in the size of an organ or tissue caused by enlargement of its cellular components.

17. inflammatory: relating to a diseased condition of some part of the body, resulting from injury, infection, irritation, etc., and characterized by redness, pain, heat, and swelling.

18. inspissated: thickened by evaporation or absorption of fluid.

19. lesion: a wound or injury.

20. lobar: relating to any lobe or lobes.

21. lobule: a small lobe or one of the subdivisions of a lobe.

22. meninges: the three membranes that envelop the brain and the spinal cord; dura mater, arachnoid, and pia mater.

23. mottle: marked with blotches, streaks, and spots of different colors or shades.

24. mucoid: any of a group of substances resembling mucin and occurring in connective tissue (like mucus).

25. necropsy: examination of a dead body.

26. parenchyma: the essential or functional tissue of an organ as distinguished from its connective tissue, etc.

27. pleura: a thin, serous membrane lining each half of the chest cavity and enveloping the lungs.

28. pulmonary: of, like, or affecting the lungs.

29. punctate: marked with dots or tiny spots.

30. purulent: of, like, containing, or discharging pus.

31. rugose: having or full of wrinkles; corrugated.

32. sinusoidal: relating to a blood space in certain organs, as the spleen, liver, and pancreas.

33. stippled: speckling of a structure with fine dots.

34. stricture: a circumscribed narrowing or stenosis of a passage in the body.

35. thoracic: relating to the chest; the upper part of the trunk between the neck and the abdomen.

36. tortuous: full of twists, turns, curves, or windings.

37. turgid: swollen; distended; bloated; inflated.

38. ulcerated (ulcer): an open sore (other than a wound) on the skin or some mucous membrane, such as the lining of the stomach,

characterized by the disintegration of the tissue and, often, the discharge of pus.

39. undulant: having an irregular wavy form, margin, or surface.

40. visceral: relating to an internal organ, especially one of the large abdominal organs.

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