


FORENSIC PATHOLOGY



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A Handbook for Pathologists

Edited by

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PREFACE BY EDITORS

Our work was easy. We had a fine group of experts in the very broad field of pathology who did the majority of the work in writing this manual. We have tried to preserve the flavor of each person's style of writing. A few notes have been added to explain different points of view, but the content of the chapters represents the viewpoint of the individual authors.

Our goal was easy. We wanted to help make available to pathologists a workbook small enough to be packed in the bag with the autopsy instruments; short enough to make it possible to review any given chapter prior to (or during) an autopsy.

We give it to you— the pathologists.

We hope you find it useful—and use it.

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CONTENTS

Contributors	
Preface by Editors	
Chapter	
I Forensic Autopsy Procedure —Leslie I. Lukash, M.D. . . .	1
II Forensic Autopsy: A Procedural Outline —Frank P. Cleveland, M.D.	7
III The Autopsy Protocol —John F. Barton, M.D. and Charles S. Petty, M.D.	10
IV Preservation of Medicolegal Evidence —Arthur J. McBay, Ph.D.	17
V Postmortem Chemistry of Blood, Cerebrospinal Fluid and Vitreous Humor —John I. Coe, M.D.	21
VI Time of Death—Time of Injury —George S. Loquvam, M.D.	50
VII Postmortem Changes and Artifacts —Russell S. Fisher, M.D.	56
VIII Identification —Charles J. Stahl, M.D.	64
IX Sudden Unexpected Death —John I. Coe, M.D.	72
X Instantaneous "Physiologic" Death —Charles S. Petty, M.D.	77
XI Sudden Infant Death Syndrome (Crib Death) —Jerry T. Francisco, M.D. and Charles S. Hirsch, M.D.	83
XII The Battered Child —George S. Loquvam, M.D.	87
XIII Rape —The Forensic Pathology Committee, College of American Pathologists	92
XIV Abortion —Russell S. Fisher, M.D.	100
XV Fire Victims —John F. Edland, M.D.	104
XVI Electrical Injuries and Lightning —John F. Edland, M.D.	111
XVII Heat and Cold —Michael M. Baden, M.D.	117
XVIII The Neck —Leslie I. Lukash, M.D. and Charles S. Hirsch, M.D.	119
XIX Asphyxial Deaths —Allan B. McNie, M.D.	123
XX Drowning —William G. Eckert, M.D. and Charles S. Hirsch, M.D.	129

	Page
XXI Adolescent Sex Hangings— John F. Burton, M.D.	133
XXII Characteristics of Wounds Produced by Handguns and Rifles— Frank P. Cleveland, M.D.	136
XXIII Shotgun Wounds— Charles S. Hirsch, M.D.	144
XXIV Cutting and Stabbing Wounds— Charles J. Stahl, M.D. . .	151
XXV Blunt Trauma: General— Jerry T. Francisco, M.D.	160
XXVI Blunt Trauma: Specific Injuries— Michael M. Baden, M.D. and Charles S. Petty, M.D.	164
XXVII Drug Deaths by Injection— Charles S. Hirsch, M.D.	168
XXVIII Deaths by Inhalation or Ingestion of Drugs and Other Poisons— Allan B. McNie, M.D.	172
XXIX Alcohol— Arthur J. McBay, Ph.D.	179
XXX Therapeutic Misadventure— Charles S. Petty, M.D.	185
XXXI The Motor Vehicle Crash: Medicolegal Investigation— Charles S. Petty, M.D. and William G. Eckert, M.D.	189
XXXII A Forensic Library for a Non-Forensic Pathologist— Charles S. Petty, M.D.	196

Chapter I

FORENSIC AUTOPSY PROCEDURE

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Introduction, Concepts and Principles

It is assumed that all pathologists know the construction and requirements for reporting the findings of a complete postmortem examination. The following is a guide for use in converting the standard autopsy protocol into the report of a medicolegal autopsy. All of the usual descriptive technics should be maintained. Greater attention to detail, accurate description of abnormal findings, and the addition of final conclusions and interpretations, will bring about this transformation.

The **hospital autopsy** is an examination performed with the consent of the deceased person's relatives for the purposes of: (1) determining the cause of death; (2) providing correlation of clinical diagnosis and clinical symptoms; (3) determining the effectiveness of therapy; (4) studying the natural course of disease processes; and (5) educating students and physicians.

The **medicolegal autopsy** is an examination performed under the law, usually ordered by the Medical Examiner and Coroner¹ for the purposes of: (1) determining the cause, manner,² and time of death; (2) recovering, identifying, and preserving evidentiary material; (3) providing interpretation and correlation of facts and circumstances related to death; (4) providing a factual, objective medical report for law enforcement, prosecution, and defense agencies; and (5) separating death due to disease from death due to external causes for protection of the innocent.

The essential features of a medicolegal autopsy are: (1) to perform a complete autopsy; (2) to personally perform the examination and observe all findings so that interpretation may be sound; (3) to perform a thorough examination and overlook nothing which could later prove of importance; (4) to preserve all information by written and photographic records; and (5) to provide a professional report without bias.

¹ Editors note: In some jurisdictions the health officer, district attorney or others may order an autopsy.

² Editors note: Sometimes referred to as "mode" of death.

Preliminary Procedures

Before the clothing is removed, the body should be examined to determine the condition of the clothing, and to correlate tears and other defects with obvious injuries to the body, and to record the findings. The clothing, body, and hands should be protected from possible contamination prior to specific examination of each. A record of the general condition of the body and of the clothing should be made and the extent of rigor and lividity, the temperature of the body and the environment, and any other data pertinent to the subsequent determination of the time of death also should be recorded.

After the preliminary examination the clothing may be carefully removed by unbuttoning, unzipping, or unhooking to remove without tearing or cutting. If the clothing is wet or bloody, it must be hung up to dry in the air to prevent putrefaction and disintegration. Record and label each item of clothing. Preserve with proper identification for subsequent examination. Clothing may be examined in the laboratory with soft tissue x-ray and infrared photographs in addition to various chemical analyses and immunohematologic analyses.

Autopsy Procedure

The date, time and place of autopsy should be succinctly noted, and where and by whom it was performed, and any observers or participants should be named. The body should be identified, and all physical characteristics should be described. These include age, height, weight, sex, color of hair and eyes, state of nutrition and muscular development, scars, and tattoos. Description of the teeth, the number present and absent, and the general condition should be detailed noting any abnormalities or deformities, or evidence of fracture, old or recent. In a separate paragraph or paragraphs describe all injuries, noting the number and characteristics of each including size, shape, pattern, and location in relation to anatomic landmarks. Describe the course, direction, and depth of injuries and enumerate structures involved by the injury. Identify and label any foreign object recovered and specify its relation to a given injury.

At least one photograph should be taken to identify the body. Photograph injuries to document their location and be certain to include a scale to show their size. Photographs can be used to demonstrate and correlate external injuries with internal injuries and to demonstrate pathologic processes other than those of traumatic origin.

Roentgenographic and fluoroscopic examinations can be used to locate bullets or other radio-opaque objects, to identify the victim, and to document fractures, anatomic deformities, and surgical procedures when such metallic foreign bodies as plates, nails, screws, and wire sutures have been used.

A general description of the head, neck, cervical spine, thorax, abdo-

men, genitalia, and extremities should be given in logical sequence. The course of wounds through various structures should be detailed remembering variations of position in relationships during life versus relationships after death and when supine on the autopsy table. Evidentiary items such as bullets, knives, or portions thereof, pellets or foreign materials, should be preserved and the point of recovery should be noted. Each should be labelled for proper identification. Each organ should be dissected and described, noting relationships and conditions.

Special Examinations and Dissection Technics

Head. First examine the exterior of the scalp for injury hidden by the hair and the interior of the scalp for evidence of trauma not visible externally. Note the course and extent of fractures. When removing the calvarium keep the dura intact (subdural hemorrhage can thus be preserved for measurements). Strip dura from the calvarium to expose any fractures. Use a dental chart to specifically identify each tooth, its condition, the extent of caries and location of fillings.³ Note the absence of any teeth. Examine both the upper and lower eyelids for petechial hemorrhages and the eyes for hidden wounds. Examine the ear canals for evidence of hemorrhage indicative of fracture. Examine the interior of the mouth, lips, and cheeks for evidence of trauma.

Neck. External examination of the neck should include observation of all aspects for contusions, abrasions, or petechiae. Manual strangulation is often characterized by a series of linear or curved abrasions and contusions. Ligature strangulation is characterized by a linear abrasion and some ligatures may produce definitive patterned abrasions. Ligature strangulation generally produces linear abrasion in a horizontal plane. Hanging characteristically produces a deep grooved abrasion with an inverted "V" at the point of suspension and a pattern may also be produced. Indistinct or obscure external injuries may become more apparent at completion of autopsy after blood has drained and the tissues begin to dry. For internal examination of the neck dissect the chest flap upward to the level of the chin, expose the neck muscles and organs after the neck vessels have been drained of blood by removal of the heart. Note the location of hemorrhage into muscles. Hemorrhage will be greatest in manual strangulation or severe blunt trauma of the neck. Remove the neck organs intact including the tongue. Dissect with extreme care so as not to break the hyoid bone during removal and dissect the muscles from the bone. Hemorrhage will be noted at the site of fracture. Thyroid or cricoid cartilages may also be fractured in manual strangulation and hemorrhage will be noted at the site of these fractures. The mucosa of the larynx, pyriform sinuses, and esophagus may show petechiae or hemorrhage. Examine the cervical spine anteriorly

³ Editors note: In those cases where dental description is of crucial importance, a dentist may be of great assistance.

for hemorrhage in the muscles along the vertebrae. Hemorrhage will be present at the site of fractures of the cervical vertebrae. When vertebrae C-1 and C-2 are fractured dissection should be carried out from the posterior approach. The characteristic signs of asphyxia are cyanosis, petechiae in the conjunctivae, sclerae, eyelids, face, neck, upper chest, and internally in the pericardium, epicardium, and pleurae.

Cervical and thoracic spine. The cervical spine may be examined anteriorly or posteriorly. High cervical injuries are best demonstrated by the posterior approach. The thoracic spine may be readily examined from the interior (anterior) approach. Identify the specific injured vertebrae. Note any fracture, dislocation, compression, or evidence of hemorrhage at the site. Dissect the soft tissue and muscle from the surface in order to view the vertebral bodies. Small projectiles may enter vertebrae by splitting fibers and leave little obvious evidence of entrance. Open the spinal canal. Remove the cord to demonstrate any injury.

Chest. Detail fractures of ribs. Cardiopulmonary resuscitation accounts for many fractures of ribs and sternum. Use caution in opening the chest so as to preserve evidence of pneumothorax and air embolism. Air embolism is usually made obvious by distention of the heart and the presence of frothy fluid within the cardiac chambers and peripheral vessels. Record the quantity of fluid or blood within the pericardial sac and pleural cavities. Caution: Never discard fluid recovered from body cavities until after all known foreign objects or projectiles have been located.

Abdomen. Note the relationships of organs one to another. Measure any fluid present. Trace the course of injuries prior to removal of the organs. Preserve the gallbladder and urinary bladder intact to have the fluids available for toxicologic specimens if necessary. Remove the alimentary tract intact to prevent possible contamination of other viscera in case it is necessary to preserve organs for toxicologic examination. Attempt to locate projectiles prior to removal and dissection of organs.

Extremities. In all suspicious and all homicidal deaths, the hands should be protected from contamination by being covered with plastic bags.⁴ The lateral surfaces of the arms, extensor surfaces of the forearms, and dorsal aspects of the wrists and hands should be examined in detail for evidence of defense wounds. Incised wounds of the palmar aspects of the hands and fingers are frequently seen in cases of stabbing. Observe each finger for evidence of broken fingernails or broken fingers. Trace evidence may be recovered from beneath fingernails; however, care should be taken not to inadvertently include tissue from the victim. The hands may be examined for powder residue employing neutron activation analysis or atomic absorption technics. Powder residue or blast injuries

⁴ Editors note: Paper bags are sometimes preferable, particularly if the body is to be stored in cool temperatures. Less "sweating" or moisture condensation occurs.

may be noted on hands. Palmar aspects of hands and fingers may be examined by trace metal detection technics.

External genitalia. Examine for evidence of foreign material such as semen. Note any abrasions or contusions, their size, location, and number, and include evidence of injury along intertriginous surfaces of the thighs. To collect foreign hair samples use a fine comb to remove all loose hairs. Collect the hairs and place in identified containers. Aspirate fluid from vaginal canal for determination of acid phosphatase and blood group substance and examination for spermatozoa. Record obvious injury as possible source of hemorrhage.

Internal genitalia. Examine and describe the organs *in situ*. Remove carefully with blunt and sharp dissection using extreme care not to use instruments upon the cervix, which might confuse injuries produced by instrumentation on the cervix and uterus. Note and preserve any fluid or foreign material within cervix, uterus, or vagina.

Special Procedures

Collection of specimens. Have a variety of containers to meet individual requirements, such as, solid material, fluid material, and foreign objects. Collect tissue and fluids for chemical analysis in chemically clean containers. Identify each specimen as to organ or fluid. Label with the name of the deceased, the date, and the name of the examiner. Seal and store in the refrigerator or freezer. Hair samples may be obtained by plucking to secure entire hairs including roots. Obtain representative samples from several areas, and label each as to source, such as scalp or pubis. Take a sample of blood directly from the heart after opening the pericardial sac. A minimal sample is 100 ml. In cases of drowning take individual samples from both the right and left sides of the heart. Obtain all urine and bile that is available. Obtain adequate quantities of visceral organs and place each in a pint jar or equivalent container. Obtain samples from the stomach and small intestine, and identify individually. Preserve the chain of evidence by maintaining absolute control of specimens.

Observations relating to determination of the time of death include: (1) the stage of rigor mortis; (2) the degree, location, and fixation of postmortem lividity or livor mortis; (3) skin slippage, postmortem suggillations; (4) temperature of the body and viscera; (5) condition of the alimentary tract, the presence or absence of food, and the stage of digestion; (6) foreign items such as fly eggs or maggots; and (7) post-mortem artifact or tissue destruction. These postmortem or putrefactive changes are secondary to the effect of scavenger insects and animals.

On the scene examinations may be helpful when possible to personally observe circumstances and conditions relating to the body.

Pitfalls that may be encountered include: the failure to make any of the preceding observations; the assumption of the cause of death and

failure to perform a complete autopsy; and the determination of time of death versus time of infliction of the fatal injury. An individual may sustain a fatal injury and survive for a long period of time prior to death.

Chapter II

FORENSIC AUTOPSY: A PROCEDURAL OUTLINE

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1. Introduction, Concepts, and Principles

- a. **Definition of medicolegal autopsy.** The medicolegal autopsy is difficult to define. Basically, it is an autopsy carried out under the laws of the State for the protection of its citizens. As such, the performance of the autopsy presupposes *State*, not *individual* permission. The importance to the State transcends the usual individual right to sepulcher until after the autopsy is completed.
- b. **Reasons for performing a medicolegal autopsy.**
 - (1) To determine cause and manner of death.
 - (2) To approximate time of death.
 - (3) To identify, collect, and preserve physical evidence.
 - (4) To provide factual information to law enforcement agencies, prosecutors, defense attorneys, families, news media and others with need to know.
 - (5) To protect the innocent as well as to assist in the identification and prosecution of the guilty.
- c. **Requirements.**
 - (1) Complete autopsy, no exceptions.
 - (2) Thorough examination, overlook nothing.
 - (3) Factual, objective written report without prejudice, advocacy, or theory.

2. Preliminary steps.

- a. Examine the body before removal of the clothing.
- b. Protect the clothing, body and hands from contamination; preserve clothing for examination at a later time.
- c. Note general state of the body.
- d. Observe the state of rigor and lividity.
- e. Determine the body temperature if applicable and other details as necessary to relate to the time of death.

3. Autopsy procedures.

- a. Note time and place of autopsy examination.

- b. External examination: apparent age, height and weight, state of nutrition, scars, tattoos, color of eyes and hair, teeth, muscular development, abnormalities, deformities, and marks of hospitalization.
 - c. Detailed examination of injuries: size, shape, location, pattern, and relationship to anatomic landmarks.
 - d. Photographs.
 - (1) To identify deceased.
 - (2) To document injuries and their location (include scale for comparison).
 - (3) To show relationship of external and internal injuries.
 - (4) To demonstrate pathologic processes other than those of traumatic origin.
 - e. X-ray and fluoroscopic examination.
 - (1) To locate bullets or other radiopaque objects.
 - (2) To identify victim.
 - (3) To document old fractures, recent fractures, anatomic deformities, metallic foreign bodies, plates, nails, and screws from surgical procedures, etc.
 - f. Internal examination.
 - (1) General examination of head, neck, cervical spine, thorax, and abdomen.
 - (2) Note course and direction of wound tracks within the body and in relationship to specific organs.
 - (3) Note relationships and conditions of viscera.
 - (4) Remember that antemortem and postmortem relationships of wounds and viscera may not always be the same.
 - (5) Preserve evidence. Recover and identify foreign objects (bullets, fragments of knives, etc.); label and establish chain of custody.
 - g. Orderly examination of the body cavities and viscera.
- 4. Procedures frequently used in forensic autopsies.**
- a. Collection of specimens.
 - (1) Hair from scalp and pubis.
 - (2) Comb pubic hair for foreign hairs.
 - (3) Collect specimens of blood, urine, and bile.
 - (4) Collect specimens of viscera, and body secretions.
 - (5) Collect any likely material for examination to determine presence of semen and sperm.
 - (6) Place specimens in chemically clean containers.
 - (7) Store in refrigerator or freezer.
 - (8) Properly identify and label specimens.
 - (9) Preserve "chain of evidence"—control of specimens.
 - b. Clothing.
 - (1) Examine prior to removal.