FORECNSIC PATHOLOGIST

1. Introduction
   a. Forensic medicine applies medical specialties to legal issues
   b. Pathology is the study of disease
   c. Forensic Pathologist is a medical doctor who conducts autopsies to determine the cause, manner, and mode of death by examining the internal organs of the corpse
   d. Usually examine unexpected deaths
   e. Deaths that are unexpected or thought to be caused my injury or poison is always investigated to see if it is a homicide
   f. Homicide: a death caused by an act of another with intent to produce bodily injury or death or done with disregard for the possibility that it could produce injury or death

2. Coroner System
   a. Coroner is usually government agent who investigates the cause of death.
   b. Existed in England before the 10th century
   c. They had many duties of investigation including to investigate deaths
   d. No federal death investigation operations in US until 1990s
   e. No medical training required

3. Medical Examiner System
   a. Movement in late 19th century to establish training for certain professions; problem when trying to professionalize the coroner profession
   b. No education or training was required
   c. 1877 MA replaced coroners with medical examiners and required them to practice medicine
   d. County coroner didn’t transition well as people moved into urban areas; many cities moved to medical examiner
   e. There were many local scandals that were not investigated well by coroners
   f. Some places still have coroners and medical examiners
   g. 1990 Federal Medical Examiners Office
4. Education and Training of Forensic Pathologists
   a. Pathologists appear in the Europe and US in the middle of the 19th century → advances of microscopes
   b. Pathologists study disease, causes and its diagnosis
   c. Early Pathologists examined tumors to see if cancerous and they examined bodies of deceased to determine cause of death
   d. Pathologists later began to manage labs where blood and urine were tested to see concentrations of chemicals
   e. By the middle of the 20th century most pathologists specialized
      i. Anatomic pathologists performed autopsies and examined tissues
      ii. Clinical pathologists managed labs where fluids are tested
   f. Pathologists began doing autopsies for police, coroners and medical examiners
   g. End of WWII → forensic pathology recognized by American Board of Pathologists
   h. In most large cities the medical examiner must by a forensic pathologist

5. Training for Forensic Pathologist
   a. Medical School: Graduate from a recognized MD or DO medical school (after bachelor’s degree)
   b. Postgraduate Training in Pathology
      i. 4 additional years after medical school
      ii. anatomic or anatomic and clinical pathology
      iii. hospitals with medical schools for training
      iv. pays a modest salary
   c. Additional Training in either anatomic or clinical pathology; training at a large coroner’s or medical examiner’s office; pays about $50K a year
   d. Many forensic pathologists train in other areas of forensic science (toxicology, anthropology, odontology)
   e. 2 – 3 day examination to be board certified
   f. about 500 in US; 25 have law and medical degrees
6. Duties of a Forensic Pathologist
   a. Overall
      i. Primarily employed to investigate deaths of those who die suddenly and unexpectedly as a result of injury
      ii. Civil and criminal litigation arises from work of forensic pathologists
   b. Determine the cause and the manner of death
      i. Cause is the medical or forensic cause
      ii. Manner is the way the death was accomplished
         1. Natural causes
         2. Accidental
         3. Suicidal
         4. Homicidal
         5. Undetermined
   c. Review Medical History
      i. Medical history is a good starting point
      ii. Death needs to meet two pronged test to see if worth investigating
         1. Is the death sudden? (within a few hours of onset of symptoms)
         2. Is the death unexpected? Look at medical records – if they have heart disease
      iii. Look for delayed effects of injury; if someone is shot and unconscious and dies years later of infection, the coroner can investigate
   d. Review Witness Statements of Activities of Deceased before the death or injury
      i. Information helps to see if one should investigate
      ii. Recreate the circumstances of death
      iii. Forensic pathologists can refute witness statements
      iv. Can lead forensic pathologist to appropriate questions but can prejudice the pathologist
e. Scene Examination
   i. Would be best to examine the scene of death or location of where the body was found
   ii. Impractical
   iii. Send forensic pathologists to scenes of death that appear to be complicated or unusual.
   iv. If not → examination of scene photographs and reviewing information from crime scene personnel

7. What happens to body at death?
   a. Temperature changes
      i. Lack of energy produced and expended
      ii. Lose 1.5 degrees F an hour
      iii. Warm up to 3 hours after death
      iv. 4 – 6 hours after death → cool to touch
      v. after 24 hours, cools to external environment
      vi. if undiscovered: bloated
          1. internal bacteria release gases
          2. putrefaction
          3. body becomes very hot (up to 127)
          4. body cracks open and gases escape
   b. Rigor mortis
      i. Begins about 4 hours after death
      ii. Stiffening of the body that results from lack of oxygen in muscle cells when heart stops
      iii. Begins in eyelids and jaw and spreads down neck and rest of the body
      iv. Effected by variables
          1. Violent struggle before death: set in more quickly
          2. Warmer air temperature will speed it up; cold air will slow it down
          3. More slowly in overweight people and faster in very thin people
      v. Usually sets in within 12 hours after death
      vi. Lasts 30 – 36 hours
      vii. Loosening goes in same progression as rigor mortis
c. Livor mortis
   i. Discoloration of skin after death caused by gravity induced settling of red blood cells in small blood vessels
   ii. Lividity: reddish condition
   iii. Becomes fixed 6 – 8 hours after death
   iv. Homicide victim face down will have lividity in the face and the chest

d. Stages in postmortem
   i. Perimortem:
      1. 4 hours
      2. pupils dilate; sphincter relaxed, body flaccid, livor mortis nonfixed
   ii. Postmortem
      1. 48 hours
      2. rigor mortis begins, livor mortis is fixed, tissues soften, decomposition begins
   iii. Decomposition: Ammonia production, marbling, liquification, putrefaction, dessication

8. Physical Evidence on the Body
   a. Before Autopsy it is necessary to examine the body for physical evidence
   b. Some examples of evidence
      i. Conditional evidence (ex. perfumes, lividity)
      ii. Pattern evidence (ex. patterns on body)
      iii. Biological evidence (ex. grass, maggots)
      iv. Chemical evidence (ex. makeup, poisons)
      v. Physiological evidence (ex. blood, semen)

9. Autopsy Examination
   a. Dissection of human body to determine cause of death has been done since the middle ages
   b. Autopsy means to look at oneself; should be called necropsy (looking at the dead)
   c. Dissection was once practiced to stop decaying process; Egypt
d. Sometimes dissection is prohibited (Middle Eastern religions); need permission of kin unless suspected in causing the death

e. Sometimes all organs and blood are returned to the body

f. Autopsy examinations entail removal through incisions, internal organs of the chest, abdomen and the head

g. T or Y shaped incision from shoulder to shoulder and down to the pubic bone

h. Brain examination: incision from one ear to behind the other ear, peel off the scalp up and backward and saw skull and remove the skull cap

i. Sometimes brain is dissected immediately or sometimes it is fixed in formaldehyde for better examination (hardens proteins; prevents decomposition)

j. After removal → organs are weighed and dissected to determine disease or injury

k. Sometimes look at internal bruising

10. Autopsy Procedure

a. Document, collect, and preserve trace evidence from body

b. Document weight, height and other physical characteristics

c. Body is photographed, x-rayed and examined with a light source for stains

d. Note distinguishing characteristics

e. If rape: swab cavities

f. Fingerprint deceased

g. Rinse body and place head on a stabilizing block

h. Y incision cut down from shoulders and down the abdomen into the pelvis

i. Saw through the collarbone and ribs; ribs spread to reveal organs

j. Organs are removed, weighed, measured and samples of blood and tissue are taken and sent to toxicology lab

k. Head examined externally

l. Cut into the scalp and scalp peeled over the face

m. Power saw to open the skull and to examine the brain (also weigh the brain)

n. Brain is dissected and preserved
After noting all internal and external factors, the medical examiner comes to a final conclusion about the cause and manner of death.

11. Obtaining Appropriate Specimens
   a. Toxicology
      i. In most forensic autopsies specimens are removed for toxicology testing
      ii. Urine removed with syringe and needle
      iii. Blood taken from aorta and large veins; bile from the gall bladder
      iv. Blood and urine used to determine presence of drugs: alcohol, opiates, cocaine
   b. Microscopic Examination: Small portions of internal organs are put into a solution of formaldehyde to “fix” them and preserve them for further study
   c. DNA analysis
      i. Most coroners and medical examiners preserve one specimen to be used for future DNA analysis
      ii. Spot of blood put on paper, dried and stored; put hairs in an envelope (need nuclear DNA from bulbs → not mitochondrial from strands
      iii. These could transmit hepatitis B or HIV
      iv. Preserved slides can also provide DNA unless in formaldehyde for too long; DNA hydrolyzed

12. Photography
   a. Forensic Pathologists must take and preserve photos of the scene and of the autopsy
   b. In urban areas, coroners and medical examiners use professional photographers but ones taken from pathologist are preferred

13. Report Preparation
   a. Written report of autopsy examination
   b. Gross autopsy are ones with unaided eye; microscopic autopsy is if tissues are looked at under a microscope
   c. Reports dictated during or right after the autopsy
   d. Hard to do during; noise and order of dissection doesn’t go well into a report form
e. Most reports have
   i. External examination
   ii. Medical treatment evidenced on body
   iii. Evidence of injuries
   iv. Dissection technique
   v. Diagnoses on gross anatomy
   vi. Microscopic examination results are after the gross
   vii. Toxicology report done by toxicologist
14. Testimony
a. Forensic pathologists spend a lot of time testifying about findings
b. Usually require a testimony from a forensic pathologist to prosecute a defendant for manslaughter or murder
c. Testify in criminal and civil courts (civil wrongs that caused death)
d. Also testify as expert witnesses even if they did not examine the body (may question another autopsy)
e. Forensic Pathologist may get extensive inquiry into their professional and private life
f. May have embarrassing questioning

15. READ CASE STUDIES