

Webinar Series
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Capital Litigation Initiative:
Crime Scene to Courtroom Forensics

Webinar 3: Forensic Pathology Essentials
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Webinar Outline

I. Head

A. Subdural

1. Looking for impact sites on the scalp to determine if it's consistent with blunt impact to head.
2. Age of subdural hematoma (liquid, organizing or chronic).
3. Acute on chronic subdural hematomata.
4. Any associated subarachnoid hemorrhage and/or underlying cortical contusion.
5. Cortical atrophy (geriatric vs alcoholic vs stroke).

B. Skull Fracture

1. Linear (consistent with short distance (ground-level) fall) vs complex (consistent with non-accidental trauma) vs multiple impacts (fracture lines not crossing or fractures on multiple surfaces).
2. Patterned fractures (depressed, "punched out" fractures)

C. Coup / Countercoup

1. Coup/countercoup combo is usually consistent with fall versus only coup contusion (consistent with blow to the head).
2. In my experience, Countercoup contusions are always larger than coup contusions, but depends on the situation.

II. Neck

A. Strangulation _ Petechial Hemorrhage

1. Petechial hemorrhages only indicate increased vascular (venous) pressure and can occur from compression of the neck, the chest and the abdomen. Strangulation is more of a collection of findings including, but not limited to abrasions on the skin of the neck, hemorrhages in the "strap" muscles of the neck,

hemorrhage of the thyroid gland and pre-laryngeal fascia, fracture of the thyroid cartilage proper or superior cornua, and/or fracture of the hyoid bone.

2. Patterned abrasions on the neck to indicate a weapon of “cervical compression”. These patterned impressions may develop over time, especially if the skin dries or if the decedent is able to drain of blood in order to enhance the contrast of normal versus injured skin.

B. Hanging Suicide vs. Homicide

1. In my experience it is based on the death investigation, scene findings in correlation with the anatomic findings on the decedent.
2. Body position, undisturbed at the scene can lend clues as to the potential for head, trunk or entire body to have caused the cervical compression on an object at the scene or with a ligature of some sort.
3. It has been taught that a suicidal hanging ligature furrow should be upgoing (obliquely-oriented with low point under the chin and high point somewhere near the face/head) whereas a homicidal ligature strangulation will be horizontal or down going. I think scene visitation of the undisturbed body in place is the best context in which to judge the circumstance (manner) of death.
4. Suicide notes in the handwriting of the decedent are helpful in order to consider suicide, but are not required as many suicidal people don't leave handwritten notes. Thorough death investigation should attempt to uncover admission of suicidality in other media (i.e. Social media, emails, texts, etc)
5. Examination of the ligature still on the neck of the decedent should also be undertaken.
6. Petechiae may not be present in suicidal hangings if the external compression of the arteries and veins precludes an increase in venous pressure above which the capillaries will lose integrity.
7. A medical/social history of depression and suicidality can help to corroborate a suicidal manner of death, however depressed people can be strangled as well.
8. Toxicology testing can also be helpful in consideration that some decedents utilize “dual modality” suicide, thus lethal or intoxicating levels of pharmaceuticals or simply the presence of a pill/tablet “bezoar” in the stomach contents can be indicative of a suicidal manner of death.
9. A more difficult discrimination is suicidal versus accidental hanging, but this can often be resolved by scene visitation of the

undisturbed decedent and careful investigation of the circumstances.

10. Any “scrimmage” type blunt force injuries (i.e. Abrasions, contusions or lacerations) of the decedent in a pattern suggesting a physical altercation and/or signs of a physical struggle at the scene (i.e. Turned over tables, drawers emptied onto the floor, missing wallet, cash and/or credit cards, unlocked and “ajar” doors) are particularly worrisome for inflicted injury.

C. Ligature marks

1. See above
2. The most important thing to judge is that the three dimensional shape of the ligature matches the impression of the ligature furrow on the skin of the neck. Thus, examination of the body with the ligature in place and the body undisturbed can yield important facts about the manner of death.

III. Chest

A. Heart Attack – Sudden Death

1. Knowledge of medical history, medication administration (nitro paste line on the skin or the decedent holding their nitro in hand), laboratory and electrographic findings and antecedent circumstances (i.e. Sudden collapse, clutching of the chest while sweating and complaining of chest pain/pressure, etc) can be enough information to verify myocardial ischemia or other cardiovascular catastrophe (at the exclusion of any lethal- or more compelling anatomic injuries).
2. Suspicion of stimulant drug use (i.e. Cocaine, amphetamine and congeners, cathinones and their congeners) would prompt toxicology testing and a full autopsy in order to correlate anatomic findings with toxicology.
3. Full autopsy with anatomic findings of cardiomegaly, severe left ventricular hypertrophy and/or –dilatation, coronary arteries or their Ostia with critical stenoses, occlusions or dissections, atheromata of the pulmonary arteries indicating increased pulmonary artery pressure (left heart failure), hemopericardium in the presence of a purulent/hemorrhagic transmural left (or more rarely right) ventricular defect, geographic areas of coagulative myonecrosis with or without areas of myocardial

fibrosis on microscopy, various other stigmata of cardiovascular disease (I.e. Pitting edema of the lower extremities, peripheral vascular disease, pulmonary edema, etc) and NO compelling levels of any toxicants.

B. GSW – pathway

1. Appropriate photography of the skin wounds (with details of indices of entrance versus exit as well as range of fire) in addition to sequential photography (entrance to exit or entrance to projectile “rest”) of the towel-cleaned wound tracks with the organs still in place can clarify the path of the projectile(s) and any areas of crossing or comingling.
2. Once the tracks have been demonstrated *in situ*, further, more detailed photographs of the visceral injuries can be performed on a photographic table.

C. GSW how fast death

1. Best determined by discussion with witnesses or visual review of video surveillance of the gunshot and collapse.
2. Occasionally, and only in certain circumstances, low volume hemorrhage in light of a devastating myocardial or aortic injury can indicate rapid death. Gunshot wounds, even to the trunk, can lead to variable periods of survival and each have to be reviewed individually.

IV. Abdomen

A. Lacerated Liver – Blunt Trauma

1. Photographs of the liver laceration both with the organs in place and the hemoperitoneum still present as well as of the towel-cleaned liver laceration following volumetric measurement of the hemoperitoneum.
2. If there is no accompanying hemoperitoneum, no defect acting as a point of egress of the blood, and/or no hemorrhage (either grossly or microscopically) of the hepatic parenchyma or capsule, the pathologist should consider an unintentional, artifactually-created, laceration by handling during the evisceration.
3. May be accompanied by fractured ribs/sternum and laceration of the spleen if high velocity motor vehicle crash.
4. Usually from anterior-posterior blunt force vector of the abdomen. In “stomping” injuries of infants or children, the liver, pancreas and even the duodenum can be lacerated by the blunt force injury compressing those viscera against the lumbar vertebral column.

B. Stomach Poisoning

1. Cyanide ingestion can cause a range of findings from erythema (red discoloration) to frank necrosis and erosion of the gastric mucosa. A smell of almonds will accompany opening of the stomach to access its contents.
2. Other ingestions (i.e. Lye or sodium hydroxide-based drain cleaner) cause frank destruction of the gastric mucosa such that it can simply dissolve, dumping the contents into the abdominal cavity or the thorax (if the esophagus is also affected)

C. Stab Wound type knife, size of knife

1. The best indicator of the individual characteristics of a stabbing instrument are patterned injuries on the skin surrounding the wound that are complimentary to the handle or hilt.
2. Serrated blades can cause characteristic curvilinear abrasions punctuated by areas of sparing at one "end" of the stab wound, but the absence of those indicia do not rule out the use of a serrated blade.
3. The most useful datum in stab wounds is what the stabbing instrument injured. Because the body is compressible, instruments can make wound tracks longer than they are or shorter than they are (if the instrument is not plunged in all the way), thus the wound track does not necessarily help with instrument length...though it can if the track is sufficiently long to suggest an instrument of uncommon length.

V. Arms/Legs

A. Defensive Wounds

1. Indicates the victim is awake, aware while being stabbed or slashed.
2. Can be utilized by prosecution to demonstrate "pain and suffering" during the penalty phase of trials.
3. If the defensive wounds are on the shoes, feet, or shins, can indicate the victim is on their back trying to protect themselves from the assailant. (Which can be even more compelling to a jury during the penalty phase)

VI. Skin

A. Livor Mortis

1. Defined as post-mortem blood settling that usually develops in 15-30 minutes following cessation of cardiac activity with the

erythrocytes settling to dependent areas of the body (I.e. If you die on your back, the blood settles to the back).

2. The erythrocytes stay intact in the blood vessels for the first 6-8 hours, so if the area of liver is pressed, the vessels are compressed and the erythrocytes are pushed out of the area. The livor is said to be "blanching"
3. After 8-10 hours, the erythrocytes coagulate and hemoglobin is released from lysing erythrocytes and extravasates from vessels so that if the area of livor is compressed, the congealed erythrocytes and/or hemoglobin staining does not move and the livor is said to be "fixed".
4. If body parts are in dependent orientations such that vascular pressure develops of gravity, the hemoglobin can extravasate under greater pressure and can stain more superficial layers of surrounding skin, causing contusion-like marks colloquially termed "Tardieu spots". These must be contextually and causally separated from contusions which are, in fact, blunt force injuries. Tardieu spots simply represent livor mortis "in extremis".

B. Gunshot stippling

1. Indicates "intermediate" range of fire, meaning the muzzle-to-skin surface distance is within 2-3 feet away, depending on the firearm and load used. The stippling is comprised of burned and unburned gunpowder striking and abrading the skin around the gunshot entrance wound. The individual stippling marks are usually very regularly shaped and the aggregate pattern is relatively evenly distributed (except in areas of sparing).
2. Stippling can be appreciated on- and underneath clothing and its pattern diameter is qualitatively directly proportional to the muzzle-to-target distance.
3. Can be confused with "pseudo stippling" created when a bullet from ANY muzzle-to-target distance passes through an intermediary target, fragmenting pieces of the intermediary target which strike the skin of the victim in a haphazard pattern with abrasions of variable sizes.
4. If there is an intermediary target, the muzzle-to-target distance can still be within 2-3 feet, but the intermediary target accepts all the gunpowder spray.

C. Age making injuries worse

1. Geriatric victims have generally thinner skin, which can lacerate much easier with less blunt force required, thus even normally benign events can cause structurally compelling injuries.

2. Because of the state of health of the elderly population, the ever decreasing “physiologic reserve” and accumulation of natural disease, an injury can exploit the fragile anatomy and physiology of the elderly victim, thus manifesting lethality with less anatomic damage (i.e. The loss of even a small volume of blood can cause malperfusion of the myocardium through already stenotic or occluded coronary arteries and result in cardiac ischemia). This can be further exacerbated by other natural disease states such as congestive heart failure or by medications taken for medical conditions (i.e. Coumadin taken for prosthetic heart valves)
3. Osteoporotic bones fracture more easily and the elderly potentially atrophic brain moves more readily within the skull, so that head motions during even benign activities can cause laceration of the bridging dural veins, resulting in a subdural hematoma.