1. DEATH CERTIFICATION/CAUSE OF DEATH

GENERAL – CAUSE OF DEATH

1. Which of the following is the most common cause of sudden death in an adult?

A. Intracerebral hemorrhage  
B. Hypertrophic cardiomyopathy  
C. Coronary artery disease  
D. Drug overdose  
E. Pulmonary thromboembolism

1. C

Sudden death is defined as unexpected death from causes either without symptoms or within 1 to 24 hours of symptom onset. The causes of sudden death in adults can be broadly divided into cardiovascular and non-cardiovascular causes. The cardiovascular causes of sudden death overwhelmingly predominate, with the most common cause being coronary artery disease. Coronary artery disease causes 80-90% of sudden cardiac deaths each year.


2. An autopsy shows that death resulted from hemopericardium secondary to a ruptured myocardial infarct following thrombosis of an atherosclerotic plaque in the coronary artery. The underlying cause of death is:

A. Coronary artery atherosclerosis  
B. Pericardial tamponade 
C. Hemopericardium 
D. Ruptured myocardial infarction 
E. Asystole

2. A


3. A 47-year old with alcohol abuse, withdrawal seizures, and bleeding varices in the past was admitted with asterixis and hepatic encephalopathy. He lapsed into coma and developed respiratory arrest, then cardiac arrest, and then died. The immediate cause of death is:

A. Cardiac arrest
B. Chronic alcoholism
C. Cirrhosis
D. Hepatic encephalopathy
E. Respiratory arrest

3. D
Hepatic encephalopathy is the immediate cause of death. Chronic alcoholism is the underlying cause of death. Cirrhosis is the intermediary cause of death. Cardiac arrest and respiratory arrest are mechanisms of death and should not be reported on the death certificate.


GENERAL – MECHANISM OF DEATH

1. Which of the following is a mechanism of death?

A) Bronchopneumonia
B) Myocardial infarct
C) Mitral valve prolapse
D) Ventricular fibrillation
E) Fatty acid oxidation disorder

1. D
Mechanisms of death include terminal events such as asystole, ventricular fibrillation, respiratory arrest and nonspecific physiologic derangements such as portal hypertension, which are differentiated by definition from nonspecific anatomic processes such as cirrhosis. Terminal events need not be reported in the death certificate. A nonspecific anatomic process or nonspecific physiologic derangement should be reported if: it is a recognized potential fatal complication of the underlying cause of death, it constitutes part of the sequence of conditions that led to death, it is not a symptom or sign of disease or injury, its existence in the patient would not be apparent unless explicitly stated, its inclusion is not an oversimplification of the facts, and an underlying cause of death is also reported. Bronchopneumonia is a nonspecific anatomic process and requires an underlying cause of death but it is not a mechanism of death. Myocardial infarct, mitral valve prolapse, and fatty acid oxidation disorder are all underlying causes of death.


2. Homicide, suicide, accident, natural, and undetermined are:

A. Causes of death
B. Codes of law
C. Manners of death
D. Mechanisms of death
E. Modes of death

2. AUTOPSY PERMISSION

GENERAL – AUTOPSY RATES

1. The overall autopsy rate in United States hospitals is closest to:

A. Less than 5 percent
B. 10-25 percent
C. 25-50 percent
D. 50-75 percent
E. Greater than 75%

1. A

It is currently estimated that the autopsy rate in hospitals in the United States is less than 10 percent. However diagnostic discrepancy rates between clinical findings and autopsy findings have not changed over the years. Many factors that contribute to low autopsy rates include: limited or no compensation for the autopsy in many settings; increasing workloads for pathologists; pathologists who lack interest or autopsy skills and do not encourage clinical colleagues to request permission for autopsies; clinicians who think there is little to learn from an autopsy since modern diagnostic techniques are so accurate, or who think they may accurately choose the deaths where autopsy may be most helpful; fear of litigation based upon unexpected autopsy findings; lack of awareness among family members of the benefits of autopsy to medical education/knowledge or to themselves.

Reference: Burton EC, Mossa-Basha M. To image or to autopsy. Annals of Internal Medicine 156 (2); 2012: 158-159.

2. Major diagnostic discrepancies between premortem and postmortem diagnoses at autopsy:

A. Have increased in the last few decades due to over reliance on diagnostic technology
B. Have markedly decreased since the development of sophisticated imaging techniques
C. Overall have remained constant at approximately 20% between 1966-2002
D. Occur in about 5% of all hospital deaths
2. C

References: Shojania KG, Burton EC McDonald KM, Goldman L. Changes in rates of autopsy-detected diagnostic errors over time: a systematic review. JAMA 289(21); 2003: 2849-2856.


3. How are the costs of performing a hospital autopsy typically covered?

A. Costs are indirectly covered by hospital overhead
B. HMOs pay a capitated fee to hospitals
C. Medicare directly reimburses hospitals for the professional fees
D. Private insurance companies reimburse

3. A

4. Which of the following statements is correct:

A. The JCAHO does not have a required hospital autopsy rate.
B. The JCAHO endorses Accreditation Council for Graduate Medical Education policy, which mandates a 15% hospital autopsy rate to accredit residency programs.
C. The JCAHO requires that 15% of deaths be autopsied.
D. The JCAHO requires that 25% of deaths be autopsied.

4. A


5. Which one of the following is true regarding national autopsy rates among patients who die in hospitals?

A. The rate has fallen considerably since 1960
B. The rate has increased dramatically since 1960
C. The rate has not changed appreciably since 1960

5. A

GENERAL – AUTOPSY REQUESTING
1. The CAP recommends that a request for autopsy be made:

A. On every death
B. Only on deaths in which the cause of death is not known with certainty on clinical grounds.
C. Only on unexpected or unexplained deaths
D. Only when it is believed that autopsy would disclose a known or suspected illness that may have a bearing on survivors

1. A


2. In general, which one of the following has legal precedence in giving permission for the performance of a hospital autopsy on the body of an adult?

A. An adult child of the deceased
B. The deceased's spouse
C. A parent of the deceased
D. The patient's physician
E. A sibling of the deceased

2. B

3. The deceased's spouse signed the authorization for autopsy. The deceased's brother calls you and wants to discuss the autopsy results. You should:

A. Determine from the spouse if it is all right to speak with the brother
B. Go ahead and discuss the case because he is a family member
C. Have his attorney prepare an authorization for release of information
D. Refer him to the deceased's former doctor who signed the autopsy authorization
E. Tell him that as the pathologist, it’s not your role to discuss findings with next of kin

3. A

3. MEDICAL EXAMINER/EXTERNAL AUTHORITY REFERRALS

GENERAL – DONATION

1. A 25-year-old man is pronounced dead after a fatal motor vehicle crash. Which of the following can be procured for transplantation before the autopsy?
1. Heart valves

B) Lung
C) Liver
D) Kidney
E) Pancreas

1. A
With the cessation of blood flow after death, solid organs such as the heart or liver cannot be used for transplantation. Heart valves, bone, dura, and corneas can be procured after death and before the autopsy.

2. The most common malignancy with an elevated risk of developing after organ transplantation is:

A) Non-Hodgkin lymphoma
B) Kaposi sarcoma
C) Hepatocellular carcinoma
D) Multiple myeloma
E) Renal cell carcinoma

2. A

4. AUTOPSY SAFETY

GENERAL – TECHNICAL/SAFETY

1. Which autopsy method involves removal of organs one by one?

A. The en bloc technique
B. The en masse technique
C. The Rokitansky technique
D. The Virchow technique

1. D

2. Which of the following organs is most susceptible to autolysis?
2. D
Autolysis is a postmortem degradation of tissue caused by the release of hydrolytic enzymes from cytoplasmic granules. Tissues with more lysosomes, such as the pancreas, are most susceptible to autolysis than tissues with fewer lysosomes such as skin, cartilage and muscle. The rate of autolysis also increases with increasing temperature (delayed refrigeration or febrile illness). Putrefaction refers to postmortem changes caused by bacterial action.

3. Implanted defibrillators:

A. Are usually inactivated by a radio-controlled device.
B. Are usually inactivated by cutting the leads.
C. Can usually be inactivated with a magnet device.
D. Usually inactivate themselves when death occurs.
E. Usually must be inactivated by the manufacturer

3. C
Implanted defibrillators monitor and record cardiac rhythm and are programmed to deliver a 30-40 J shock if ventricular fibrillation develops. Their memory may contain useful information about cardiac rhythm immediately before death which can be retrieved by trained technicians, but the defibrillator should first be inactivated with a magnet device to prevent accidental shocks to autopsy personnel. The device should not be returned to the body after autopsy as the lithium battery can explode during cremation.


4. An enterotome is:

A. An instrument for curetting bone
B. An instrument for obtaining bone cores
C. A modified long-bladed knife
D. A modified scalpel
E. A modified scissors

4. E
The enterotome is a specialized scissor that is used to open the intestines. It has one short blade and one longer blade which has a blunt end that is curved back upon itself. The blunt
end is inserted into the bowel lumen and the entrotome is advanced smoothly adjacent to the mesentery.

5. When making the saw cut for removing the calvarium:

A. It should encircle the calvarium like a hat band.
B. An obtuse angle is created on the calvarium.
C. OSHA requires the use of a vacuum saw.
D. V-shaped notches should be made bilaterally.
E. None of the above.

5. B
The calvarium is best opened by means of two intersecting lines. One encircles the anterior calvarium like a hat band from one ear to the other. The second line intersects the first at an obtuse angle. Although the calvarium could be opened in one continuous line like a hat band, the suggested method allows for more secure repositioning of the skullcap after the autopsy is completed.

6. When opening the bowel, the bowel should be cut longitudinally:

A. Adjacent to the mesenteric attachment
B. Half way between the mesenteric attachment and antimesenteric border
C. Opposite the direction of food transit
D. Opposite the mesenteric attachment

6. A
See question 92 above.

7. Which substance should be involved in processing of tissues from Creutzfeldt-Jakob cases?

A. B-5 fixative
B. Ethanol
C. Formic acid
D. Glutaraldehyde
E. Phenol

7. C
The intact brain should be fixed for a minimum of 10 days in formalin. Sections (4 to 5 mm thick) taken from the fixed brain should be agitated in 95-100% formic acid for one hour and then returned to formalin for 2 days prior to embedding. Reference: Crain BJ. Safety tips for anatomic studies of possible CJD. CAP Today 1996 Jan; 10(1):56.
8. The fixative of choice for electron microscopy is:

A. Bouin's  
B. Formalin  
C. Glutaraldehyde  
D. Phenol  
E. Zenker's

8. C

9. Histologic sections from paraffin embedded tissue are usually cut how thick?

A. 2 um  
B. 4 um  
C. 8 um  
D. 10 um  
E. 12 um

9. B


10. When assessing the presence of fat within the vasculature of the lung (fat emboli) which type of specimen is best?

A. Clorox digestion, iron stained  
B. Frozen section, Oil Red O stained  
C. Paraffin embedded, H&E stained  
D. Paraffin embedded, Oil Red O stained  
E. Paraffin embedded, Sudan Black stained

10. B

Because lipids are dissolved by routine histologic processing, histologic demonstration of fat emboli usually requires frozen sections of fresh tissue and special stains for fat such as the Oil Red O stain.


11. Studies show that the risk of HIV infection from a needle contaminated with HIV infected blood is about:

A. 0.3%  
B. 1%
C. 5%
D. 10%
E. 20%

11. A
In a prospective study of healthcare personnel with percutaneous exposure to HIV infected blood, the average risk of transmission was approximately 0.3%. The risk for transmission with mucus membrane exposure was approximately 0.09%.

12. Double gloving is recommended because:

A. Gloves tear less frequently when two pairs are worn
B. The inoculum is smaller if a needle puncture occurs compared with single gloving
C. It is easier to see when a puncture occurs
D. It mainly makes the prosector feel more secure

12. B
The volume of blood on a solid needle is reduced by up to 95% when it passes through two gloves compared to one. This is thought to dramatically reduce the inoculum of any potential blood borne pathogens that reach the skin. Some authors report that double gloving can result in as much as an 87% reduction in the risk of exposure to patient blood.


13. Latex allergy can manifest as:

A. Type 1 hypersensitivity only
B. Type 4 hypersensitivity only
C. Type 1 or Type 4 hypersensitivity
D. Type 2 hypersensitivity

13. C
Latex allergy can present as either a delayed onset (hours to days post exposure) allergic contact dermatitis (type IV hypersensitivity reaction) or an immediate onset (minutes post exposure) hypersensitivity reaction (type I hypersensitivity reaction) with skin and potentially life-threatening systemic symptoms.
14. Which of the following possesses the greatest infectivity via accidental needle stick?

A. Hepatitis A  
B. Hepatitis B  
C. Hepatitis C  
D. HIV  
E. TB

14. B. According to the CDC, following an accidental needle stick, the average risk of seroconversion for Hepatitis B virus was 37-62% if the source blood was positive for both surface antigen and e antigen and 23-37% if the source blood was surface antigen positive but e antigen negative. The risk of hepatitis C transmission after a needle stick averages 1.8%, and the risk of HIV transmission is about 0.3%


15. High risk or potentially high-risk autopsies include all of the following EXCEPT:

A. Acute respiratory distress syndrome  
B. Acquired immune deficiency syndrome  
C. Jakob-Creutzfeldt disease  
D. Tuberculosis, active  
E. Viral hepatitis

15. A Choices B through E all represent readily transmissible infectious diseases. Acute respiratory distress syndrome (ARDS) refers to a pattern of diffuse lung injury which can be caused by a wide variety of infectious and noninfectious agents.

16. All of the following are true regarding completion of the autopsy EXCEPT:

A. The body should be cleaned with mild detergent  
B. Fluid should be returned to the body  
C. The head should be covered with a plastic bag  
D. The incisions should be closed  
E. Organs may be placed in a heavy plastic bag and placed in the body cavity
16. B


17. Nitro-blue tetrazolium or triphenyltetrazolium chloride may be helpful for gross detection of:

A. Alcoholic cardiomyopathy  
B. Hypertrophic cardiomyopathy  
C. Infective endocarditis  
D. Myocardial infarct  
E. Viral myocarditis

17. D

Early myocardial infarctions (less than 12 hours old) are often not grossly identifiable. If the infarct is more than 2 to 3 hours old, however, it may be demonstrated by immersing slices of the ventricles in triphenyltetrazolium chloride solution. Intact myocardium will contain dehydrogenase enzymes and will turn brick red. Infarcted myocardium, which lose dehydrogenase enzymes through damaged cell membranes, will remain pale.


18.

Organs and trimmed tissues that are used to prepare blocks in Creutzfeldt-Jakob cases should be:

A. Completely incinerated  
B. Placed in formalin  
C. Steam autoclaved and placed in formalin  
D. Washed with sodium hydroxide and placed in formalin

18. A


19. The fixative of choice for demonstrating sodium urate monohydrate deposits in gout patients is:

A. Alcohol  
B. Bouin’s
C. Formalin  
D. Glutaraldehyde  
E. Zenker’s  

19. A  

20. In cases of suspected Creutzfeldt-Jakob disease, the College of American Pathologists recommends:  
A. Autopsy limited to head  
B. Autopsy limited to head and spinal cord  
C. Autopsy not be performed  
D. Cerebrospinal fluid removal only  
E. Trephine biopsy of the brain  

20. A  

5. AUTOPSY PROCEDURES - EXTERNAL  
GENERAL – POSTMORTEM FINDINGS  

1. "Tache noire" is a(n):  
A) Incidental gross finding in some livers  
B) Premortem injury  
C) Cardiopulmonary resuscitation injury  
D) Result of poisoning  
E) Postmortem drying of the corneas  

1. E  
Tache noire is a red-brown discoloration of the corneas caused by drying after the eyelids remain open after death. This may be misinterpreted as a traumatic injury.  

2. Apoptosis is associated with:
A. Hyperthyroidism  
B. Bacterial infection  
C. Loss of cell membrane integrity  
D. Local inflammation  
E. Activation of caspases enzymes  

2. E  
Apoptosis is a tightly regulated process of cell death in which cells destined to die activate enzymes that degrade the cell’s own DNA and nuclear and cytoplasmic proteins. Apoptosis results from the activation of enzymes called caspases. The cell’s plasma membrane remains intact during apoptosis until the last stages of cell death. Apoptosis does not elicit inflammation and is not seen in bacterial infections.  


3. Apoptosis is associated microscopically with:  
A. Cellular swelling  
B. Local plasma cell infiltration  
C. Associated capillary thrombosis  
D. Nuclear chromatin condensation  
E. Mallory bodies when seen in the liver  

3. D  
Apoptosis is associated with nuclear chromatin condensation. In apoptosis, the cell shrinks rather than swells. Local inflammation or vascular thrombosis is not seen.  


4. Algor mortis:  
A. Is dependent on body position  
B. Is accelerated by premortem seizures  
C. Can be minimal or absent if there has been severe blood loss before death  
D. Is dependent on body habitus and air movement around the body  
E. Results from the postmortem conversion of ATP to ADP  

4. E  
5. Lipofuscin:

A. Commonly seen in adipose tissue  
B. Accumulates in lysosomes  
C. Induces cell death  
D. Is acid-fast positive  
E. Is iron stain positive

5. B

Lipofuscin is composed of polymers of lipids and phospholipids in complex with protein and accumulates in lysosomes in the cell. Lipofuscin does not injure the cell. Lipofuscin is commonly seen in the liver and heart of the elderly and patients with severe malnutrition. Lipofuscin does not stain with acid-fast or iron stains.


8. SPECIAL TECHNIQUES

CHEMISTRY/TOXICOLOGY

1. Which of the following imparts a brown color to lividity?

A) Hypothermia  
B) Carbon monoxide  
C) Methemoglobin  
D) Propranolol  
E) Cyanide

1. C

Livor mortis is the red-purple discoloration of the skin caused by the settling of the blood in the deep end in portions of the body to gravity. Exposure to cold (hypothermia) and carbon monoxide poisoning are associated with pink-red lividity. Certain drugs produce methemoglobinemia resulting in chocolate-brown discoloration to livor mortis. Cyanide intoxication imparts a dark red hue to livor mortis. Methemoglobin is a derivative of hemoglobin in which the ferrous iron is oxidized to the ferric state, resulting in the inability of methemoglobin to combine reversibly with oxygen. Most cases of methemoglobinemia are secondary due to exposure to drugs and chemicals increased formation of hemoglobin. These include nitrates, chlorates and quinones. Other drugs include acetanilid, phenacetin, sulfonamides, and aniline dyes. Propranolol is not one of those drugs.

2. A postmortem vitreous fluid potassium concentration of 9.5 mEq/L is indicative of:

A) Chronic renal failure  
B) Antemortem hyperkalemia  
C) Premortem potassium injection  
D) Acute adrenal insufficiency  
E) Nothing

2. E


3. The best location to draw blood for postmortem toxicology is the:

A. Aorta  
B. Femoral vein  
C. Pulmonary artery  
D. Right ventricle  
E. Inferior vena cava

3. B


4. Which of the following postmortem vitreous fluid analyte shows the best correlation with its antemortem blood concentration?

A. Potassium  
B. Glucose  
C. Creatinine  
D. Lactate dehydrogenase  
E. Phosphorus

4. C

9. FREQUENT FINDINGS

BONE

1. An 84-year-old man died of high output cardiac failure. His cranium was prominent and the skull was irregularly thickened and nodular, consisting of very dense pumice-like bone. The most likely diagnosis is:
   A. Albright syndrome
   B. Fibrous dysplasia
   C. Metastatic carcinoma
   D. Osteogenic sarcoma
   E. Paget disease

1. E  Paget disease of bone may not be clinically recognized if the long bones are not particularly affected (both monostotic and polyostotic forms occur). In some patients, calvarial changes precede clinically obvious long bone involvement. When the skull is thickened for unknown reasons it is useful to obtain samples of the long bones for potential future studies, since the long bone changes may be macroscopically subtle and may not be recognized until histologic sections are prepared. High output cardiac failure is a known complication of Paget disease.

2. At autopsy it is not unusual to find defects in the central portions of one or more of the vertebral bodies in individuals of all ages, without clinical findings. These empty spaces, which are generally round or slightly oval, and halfway between the upper and lower borders of the vertebral bodies, are most likely:
   A. Metastatic carcinoma
   B. Myeloma
   C. Normal anatomic variant
   D. Schmorl nodules
   E. Secondary to disc degeneration

2. C  The vertebral bodies form from two different precursor bodies (sclerotomes). The sclerotomes separate into upper and lower halves, which then fuse with the corresponding lower and upper halves of the adjacent sclerotomes to form the vertebral body. In the embryonic state, there is a prominent blood vessel between the original sclerotomes, the remnant of which can persist as a space marking the line of fusion of the sclerotome halves. This space is normal, without clinical or morphologic significance, and should not be interpreted as a lytic lesion.

3. Schmorl nodules are:
A. Bony exostoses  
B. Calcified granulomas  
C. Esophageal diverticula  
D. Herniated nucleus pulposus  
E. Skin tumors

3. D  Schmorl described the lesion of herniation of nucleus pulposus into the adjacent vertebral body, sometimes with development of hyaline chondrification and even ossification. The vertebral body cortex is interrupted and the Schmorl nodule sometimes resembles an enchondroma. There is no other clinical significance to this lesion.

BREAST

1. A woman in her fifties was treated for node positive HER2 positive breast cancer six years ago. She developed pneumonia and was hospitalized. An echocardiogram showed systolic heart failure and left ventricular dilatation. She succumbed to sepsis and an autopsy was performed. No metastatic carcinoma was found. Microscopically the heart showed moderate vacuolation of the myocytes. Her heart disease was most likely related to:

A. Amyloidosis  
B. Arrhythmogenic cardiomyopathy  
C. Coronary artery disease  
D. Tamoxifen therapy toxicity  
E. Trastuzumab and anthracycline toxicity

1. E  Systolic heart failure is a recognized complication of both trastuzumab and anthracycline chemotherapy agents (such as Adriamycin). Both of these agents are commonly used in the treatment of HER2 positive breast cancer. The cardiac histiologic and ultrastructural changes are subtle and include primarily loss of myofibers with vacuole accumulation.

2. A 61-year-old woman died from complications following an above-knee amputation. She had poorly controlled diabetes for many decades. On external examination, a 4 cm firm lump is palpated in the left breast. During autopsy (while reflecting back the skin and soft tissue from the chest wall), the lump is incised from behind. Microscopically it showed dense hyalinized stroma with lymphocytic infiltrates surrounding lobules, ducts, and blood vessels. There was apparent loss of lobules and the duct basement membranes were thickened. Some stromal fibroblasts and myofibroblasts had large hyperchromatic nuclei. There are no palpable axillary lymph nodes. The most likely diagnosis is:

A. Diabetic mastopathy  
B. Fibroadenoma  
C. Infiltrating lobular carcinoma
D. Pseudoangiomatous stromal hyperplasia
E. Radial scar

2. A Diabetic mastopathy is an inflammatory stromal lesion of the breast occurring most often in patients (men and women) with long standing diabetes. The etiology is thought to involve abnormal glycosylation of proteins. The presentation is usually a firm mass that may be painful. Histologically they are characterized by periductal, perilobular, and perivascular lymphocytic inflammation accompanied by proliferation of fibroblasts and myofibroblasts.

3. A 57-year-old woman with a history of breast cancer treated with chemotherapy and radiation (after surgery) 20 years ago develops a painful indurated skin lesion over her mastectomy site with purple papules. She is hospitalized for apparent pneumonia and subsequently dies. The autopsy permission includes sampling of the skin lesion, which shows pleomorphic spindle cells as part of a network of inter-anastomosing vascular channels. The lungs show bilateral hemorrhagic nodular lesions with similar histology. The most likely diagnosis is:

A. Epithelioid hemangioendothelioma
B. Kaposi sarcoma
C. Metastatic carcinoma
D. Post irradiation cutaneous angiosarcoma
E. Paget disease of the nipple

1. E Post-irradiation cutaneous angiosarcoma is a rare late complication of radiation in younger patients with breast cancers and Hodgkin lymphomas. They represent the extreme end of the spectrum (or possible malignant transformation) of atypical vascular lesions, which develop earlier and have more indolent behavior.

**CARDIOVASCULAR**

1. A 62-year-old man, with a long history of smoking, complained of upper back pain for approximately three months. Chest x-ray demonstrated an expansile mediastinal mass, thought to be a large aneurysm of the descending thoracic aorta, with erosive changes of the anterior portion of the vertebral bodies. He died suddenly and autopsy confirmed the clinical findings. The most likely etiology of the aneurysm is:

A. Atherosclerosis
B. Infection
C. Marfan syndrome
D. Syphilis
E. Trauma
1. A Although syphilis was, at one time, a common cause of thoracic aneurysm, it is now exceedingly rare. Infectious aortitis, most commonly due to septic emboli, is likewise rare. Marfan syndrome generally affects the aortic root and ascending aorta. It only accounts for approximately 5% of thoracic aortic aneurysms. Chest trauma is more likely to result in a pseudoaneurysm than an true aneurysm. Proximal to the ligamentum arteriosum, most aortic aneurysms are non-atherosclerotic in etiology, while distal to the ligamentum arteriosum, most cases are due to the usual form of atherosclerotic degenerative disease.


2. A 28-year-old woman had systemic lupus erythematosus for nine years. She presented with joint and skin manifestations, with marked elevation of anti-nuclear antibody titers, but was well controlled with steroids and Plaquenil. There was no evidence of renal or neurologic disease. She developed increasing congestive heart failure and marked cardiomegaly on chest x-ray. No murmurs were heard. An endomyocardial biopsy showed vacuolated myocytes with lamellar bodies. Blood cultures were sterile. She died of intractable cardiac failure with tachyarrhythmia approximately six weeks after the heart biopsy. At autopsy, the heart weighed 670 g. There was four chamber dilatation, without grossly obvious necrosis or fibrosis. The valves were unremarkable. The most likely diagnosis is:

A. Bacterial endocarditis
B. Hypertensive cardiomyopathy
C. Libman-Sacks endocarditis
D. Plaquenil-associated cardiomyopathy
E. Ischemia cardiomyopathy

2. D Plaquenil therapy can be complicated by a dilated cardiomyopathy. Libman-Sacks endocarditis is virtually non-existent, perhaps because of modern therapies, and is typically seen as a fibrin vegetation on the under-surface of the posterior leaflet of the mitral valve. There was no endocarditis seen in this case. The coronary arteries, as expected in a young woman, were unremarkable. Her blood pressure was normal, also as expected, since she did not have renal disease.


3. A 51-year-old previously healthy, slightly obese man, who had lived all of his life in New Jersey, died suddenly of myocardial infarction, confirmed at autopsy. His spleen weighed 250 g. The splenomegaly is most likely due to:
A. Amyloidosis  
B. Chronic lymphocytic leukemia  
C. Congestive heart failure  
D. Gaucher disease  
E. Malaria  

3. Congestive heart failure can cause modest increase in spleen size. Splenic amyloidosis is associated with a predisposing condition, generally inflammatory. The spleen of Gaucher disease is generally quite large and patients are not without signs or symptoms of Gaucher at this age. The spleen of chronic lymphocytic leukemia is generally greater than 600 g.


4. A 59-year-old woman died suddenly. A native of the Philippines, she had a 10-year history of an ascending thoracic aorta aneurysm for which she refused treatment. She was hypertensive and hypercholesterolemic. At autopsy, there was hemopericardium and a site of leakage from the 10 cm saccular aneurysm, which extended from the ring of the aortic valve to a point 2 cm proximal to the origin of the right subclavian artery. The heart and valves, including the sinus of Valsalva, were unremarkable. The entire aorta, including the aneurysm, was remarkable for the minimal degree of atherosclerotic change, even less than anticipated for her age. There were no thrombi in the aneurysm sac. The wall of the aneurysm was thin and translucent, and the aneurysm intima had only a few small yellow atherosclerotic plaques. There was no dissection. The most likely etiology is:

A. Mycotic  
B. Rheumatic  
C. Syphilitic  
D. Traumatic  
E. None of the above  

4. This aneurysm is most likely idiopathic. The typical aneurysm of syphilis has a thickened wall, with fibrosis interrupting the elastic fibers of the media and a somewhat cobblestone appearance of the intima (“tree-barking”). Chronic aortitis in rheumatic diseases may show similar changes. There was no evidence of atherosclerosis, infection, rheumatic disease or genetic connective tissue disorder in this case. Generally traumatic aneurysms show evidence of prior trauma, with old hemorrhage and adventitial fibrosis. These changes were not seen here and, in addition, she had no history of trauma. She also had no clinical or morphologic evidence of aortic stenosis and the aneurysm did not appear to be “post-stenotic.”

5. The location of the sinoatrial node can be identified grossly because:

A. it is at the juncture of the left anterior descending and circumflex arteries  
B. it is fed by the septal perforating artery  
C. it is on the right atrial appendage  
D. it is red  
E. it surrounds the sinoatrial artery

5. E
The sinoatrial artery is always surrounded by sinoatrial node tissue. The artery generally can be found at the junction of the superior vena cava and the right atrium. It varies somewhat in terms of its anterior-posterior location, but can be found by incising the superior vena cava longitudinally until the sinoatrial artery lumen is identified. The task becomes easier in older individuals since there is increasing collagenization of the sinoatrial node with age and the artery appears to have a thick wall.


6. A 55-year-old man died following an episode of chest pain. His serum troponin I was increased. At autopsy, there was a 3 x 4 cm transmural area of dark mottled myocardium involving the anterior left ventricle. What is the most likely estimate of the length of time for this lesion to develop?

A. less than 1 hour  
B. 2-4 hours  
C. 12-24 hours  
D. 24-48 hours  
E. 3-5 days

6. C
In acute myocardial infarction, the earliest changes seen with the naked eye include reddish-blue discoloration of the infarct due to stagnated blood. Between 1-3 days, the infarct becomes more yellow and soft. It becomes more defined by a hyperemic border after 3 days.


7. A 60-year-old woman with a history of uncontrolled diabetes mellitus suffered an acute myocardial infarction complicated by congestive heart failure. While in the intensive care unit, she had a sudden worsening of her cardiac function. A
pericardiocentesis yielded liquid blood, and she died soon after. What is the most likely interval of time from her initial cardiac event until her death?

A. 2-6 hours  
B. 6-18 hours  
C. 1-3 days  
D. 4-7 days  
E. 1-2 weeks

7. D  
Cardiac rupture can occur at any time post-myocardial infarction, but is most commonly encountered four to seven days after the cardiac event. Rupture occurs because of weakening of the myocardium from necrosis and acute inflammation, especially if there is transmural infarction. It may appear earlier in this time frame in hospitalized patients who receive pressor agents than in patients who do not seek medical attention. Cardiac rupture almost always results in death. Rupture through the ventricular free wall leads to hemopericardium and cardiac tamponade.


8. At autopsy, sectioning of the heart reveals a 3 x 5 cm white firm scar in the left lateral ventricular wall. How long ago did this patient most likely have a coronary artery occlusion?

A. 1 week  
B. 2 weeks  
C. 3 weeks  
D. 1-2 months  
E. >2 months

8. E  
Scar tissue contributes to the gross appearance of a resolving infarct after 2 weeks, resulting in a grey-brown gelatinous depressed area. This eventually becomes a more firm and white fibrous tissue by three months.


9. A 49-year-old man developed sudden severe chest pain and died. At autopsy, a left anterior descending artery thrombosis was seen along with severe atherosclerosis of all three major coronary arteries. Which of the following histologic findings is most likely to be seen?
A. edema
B. fibroblastic proliferation
C. lymphocyte infiltration
D. macrophage infiltration
E. neutrophil infiltration

9. E
An infiltrate of neutrophils typically appear about six hours post-infarction. Neutrophilic infiltration becomes maximal at 48 hours, and neutrophils disappear after about 14 days. Macrophages and fibroblasts are seen at about day four, with the most intense macrophage accumulation after six weeks, and maximal fibroblast activity at three weeks. Lymphocytes may be seen at day four but are more abundant at the third week. Edema can be difficult to assess objectively on histology and is not a reliable guide for dating myocardial infarction.


10. A 33-year-old woman died suddenly and unexpectedly. There was a 1-week history of fever and malaise prior to death. At autopsy, the heart was enlarged and the myocardium was flabby. Histologically, there was inflammation with myocardial fiber necrosis. What is the most likely infectious agent that can produce these findings?

A. Aspergillus fumigatus
B. Coxsackie B virus
C. Neisseria meningitides
D. Staphylococcus aureus
E. Streptococcus pyogenes

10. B
In many cases of acute myocarditis, an etiologic agent is not found. However, the most important causes of acute infectious myocarditis are viruses, of which Enteroviruses, especially Coxsackie B viruses, are the most common agents identified, having been reported in up to 25 percent of cases.


11. Which of the following statements about arrhythmogenic right ventricular dysplasia/cardiomyopathy is true?

A. ARVD/C exclusively involves the right ventricle.
B. Fatty infiltration of the right ventricle is sufficient enough to make a diagnosis of ARVD/C.
C. Fatty replacement equally involves both compact and trabecular myocardium.
D. Patients can present with congestive heart failure or sudden cardiac death.
E. The right ventricular wall thickness is invariably decreased.

11. D
Although ARVD/C is known to cause sudden cardiac death in young individuals, a less common presentation is congestive heart failure. Some degree of fatty infiltration of the right ventricle, particularly of the anterolateral wall, can be observed in normal hearts and is correlated with increasing age, obesity and female gender. Fatty infiltration is often not sufficient enough by morphologic grounds to diagnose ARVD/C and to explain sudden cardiac death. Other histologic features such as significant fibrosis, inflammation and degenerative changes in the myocardium provide a more convincing diagnosis of ARVD/C. The right ventricular wall is usually thinned out and translucent but, in the so-called fatty variant of ARVD/C, the wall thickness may even be increased. The fibrofatty replacement of the myocardium often spares the trabecular myocardium. ARVD/C involves the left ventricle in approximately half of the cases in advanced disease, but may on occasion present initially as isolated or predominant left ventricular involvement.


12. The earliest change in an acute myocardial infarct after reperfusion is:
A. Contraction band necrosis
B. Loss of nuclear staining
C. Macrophage infiltration
D. Neutrophil infiltration
E. Waviness of fibers

12. A
A reperfused infarct usually appears grossly hemorrhagic. Irreversibly damaged myocytes show contraction bands as a result of exaggerated contraction of myofibrils. The other histologic changes mentioned more often observed in non-reperfused infarction.


13. Of the following congenital heart diseases, which one is most likely to present with cyanosis within the first week of life?
A. Anomalous left coronary artery from the pulmonary artery
B. Atrial septal defect
C. Patent ductus arteriosus
D. Total anomalous pulmonary venous connection
E. Ventricular septal defect
13. D
In TAPVC, cyanosis can result from mixing of oxygenated blood and poorly oxygenated blood at the site of anomalous pulmonary vein connection either above or below the diaphragm. In addition, most of these patients also have right-to-left shunting at the level of the atrial septum. In contrast, ASD, PDA and VSD result in a left-to-right shunting because right-sided pressures are lower than systemic left-sided pressures. Anomalous left coronary artery origin from the pulmonary artery usually leads to myocardial ischemia, left ventricular dysfunction and early infant mortality.


14. The first gross changes of acute myocardial infarct become apparent at:
A. 1-2 hours
B. 4-6 hours
C. 12-24 hours
D. 25-36 hours
E. >36 hours

14. C
The infarcted area may be identified grossly by the appearance of reddish-blue discoloration due to stagnated blood at 12-24 hours and becomes pale yellow-tan and soft after 24 hours. Gross changes are typically not apparent before 12 hours but may be detected with the use of triphenyltetrazolium chloride.


15. The average adult female’s heart weighs:
A. 200-250 g
B. 250-300 g
C. 300-350 g
D. 350-400 g
E. >450 g

15. B
Heart weight is roughly 0.4% of body weight.

16. The most common disease associated with acute aortic dissection is:

A. Bicuspid aortic valve  
B. Erdheim’s disease  
C. Giant cell aortitis  
D. Hypertension  
E. Marfan’s syndrome  

16. D

Hypertension is the most common risk factor identified in patients with acute aortic dissection, while a smaller number of dissections are related to connective tissue disorders or vasculitis. Bicuspid aortic valve is more commonly associated with aortic aneurysm rather than dissection. Aortic involvement in Erdheim’s disease is seen as periaortic fibrosis and perivascular infiltration by histiocytes.


FETAL (PRETERM)

1. Antepartum hemorrhage, the single largest known cause of stillbirth, accounts for what percentage of all stillbirths?

A. <5%  
B. 10-20%  
C. About 50%  
D. About 75%  
E. >90%  

B. Antepartum hemorrhage is bleeding in the later stages of pregnancy. Common causes of antepartum hemorrhage include placenta previa, placental abruption, and vasa previa. Antepartum bleeding complicates about 5% of all pregnancies, and causes 10-20% of all fetal deaths.

References:  
2. Obvious major anomalies are found in what percentage of all newborns?

A. 1-2%
B. 5-10%
C. 11-15%
D. 16-20%
E. >20%

A. Congenital anomalies of varying severity are found in 3-5% of all newborns; most of these are minor.

References:

3. Major malformations are seen in what percentage of stillborn fetuses?

A. 1-2%
B. 10-20%
C. 21-30%
D. 31-40%
E. >40%

3. B. While malformations are rarely a direct cause of intrauterine fetal demise, malformations are seen in a higher percentage of stillborn fetuses (~10-20%) than liveborn infants (~3-5%). Major anomalies mostly involve cardiac, renal, skeletal, and central nervous systems.

Reference:

4. The most common cytogenetic defect in stillbirths is:

A. Monosomy X
B. Triploidy
C. Trisomy 13
D. Trisomy 18
E. Trisomy 21
4. A. Chromosomal anomalies are seen in up to 30% of all stillborn fetuses (with relatively more in the mid-trimester; less in the third trimester). Monosomy X is most common, seen in about 20% of abnormal karyotypes. About half will have an autosomal trisomy, and 10-15% will be triploid. The remainder are tetraploid, unbalanced translocations, double trisomies, or mosaics.

Reference:

5. Growth retardation, index finger overlapping the third finger, rocker-bottom feet and abdominal wall defects are typical features of:

A. Monosomy X
B. Triploidy
C. Trisomy 13
D. Trisomy 18
E. Trisomy 21

5. D. Overlapping fingers and rocker-bottom feet are part of the classic phenotype of trisomy 18. Trisomy 13 commonly shows midline facial defects and polydactyly. Features of trisomy 21 include flat face, slanted palpebral fissures, and single palmar creases. Monosomy X will have a large cystic hygroma and dorsal pedal edema. Triploidy shows severe growth restriction, syndactyly of the 3rd and 4th fingers and toes, and hypertelorism.

Reference:

6. Cyclopia, polydactyly, open neural tube defects, scalp defects and facial clefting are typical features of:

A. Monosomy X
B. Triploidy
C. Trisomy 13
D. Trisomy 18
E. Trisomy 21

6. C. Trisomy 13 commonly shows midline facial defects and polydactyly. Trisomy 18 classically shows overlapping fingers and rocker-bottom feet. Features of trisomy 21 include flat face, slanted palpebral fissures, and single palmar creases. Monosomy X will
have a large cystic hygroma and dorsal pedal edema. Triploidy shows severe growth restriction, syndactyly of the 3\textsuperscript{rd} and 4\textsuperscript{th} fingers and toes, and hypertelorism.

Reference:

7. Pulmonary hypoplasia is noted in what percentage of neonatal autopsies?

A. <5%
B. 15-20%
C. About 50%
D. About 75%
E. >90%

7. B. Pulmonary hypoplasia is common in the perinatal period and is a significant cause of death in newborn infants, with reported incidences of around 15-20%. Common causes of pulmonary hypoplasia include renal or urinary tract anomalies, diaphragmatic hernia, and prolonged rupture of membranes. A cause of pulmonary hypoplasia may not be definitively identified in up to a third of cases.

References:

8. In newborn infants, intraventricular hemorrhage that extends into the ventricles without dilating them is graded as:

A. Grade I
B. Grade II
C. Grade III
D. Grade IV

8. B. In grade I interventricular hemorrhage (IVH), bleeding is isolated to the subependymal area. In grade II IVH there is bleeding in the ventricle without dilation of the ventricle. Grade III IVH is ventricular hemorrhage with dilation. Grade IV IVH has intraventricular and parenchymal hemorrhage.

Reference:
9. Potter’s sequence may be associated with all of the following EXCEPT:

A. Bilateral renal agenesis
B. Chronically leaking amniotic membranes
C. Congenital urethral obstruction
D. Infantile polycystic kidney and liver disease
E. Unilateral ureteral atresia

9. E. Potter's sequence is initiated by oligohydramnios from any cause (another term for Potter's sequence is oligohydramnios sequence). Since the majority of amniotic fluid is fetal urine, bilateral renal agenesis, urethral obstruction, and infantile polycystic kidney and liver disease cause oligohydramnios by reducing the urine output. Chronically leaking amniotic membranes cause oligohydramnios by simply not holding fluid. Unilateral ureteral atresia does not block the flow of urine to the amniotic cavity, and will not cause oligohydramnios. Oligohydramnios restricts fetal movement and causes fetal compression, resulting in the characteristic external features (infraorbital creases, flattened nose, flattened ears, micrognathia, redundant skin, club feet) and pulmonary hypoplasia.

Reference:

GENITOURINARY

1. Bladder trabeculation in postmenopausal women is most likely due to

A. Large ovarian tumor
B. Cervical carcinoma
C. Scleroderma
D. Severe uterine prolapse
E. Vesicorectal fistula

1. D  Bladder trabeculation is associated with bladder outlet obstruction most commonly due to prostatic hyperplasia in men and severe pelvic organ prolapse in women. In children, it can also be observed in patients with neurogenic bladders and posterior urethral valves. Rare massive bladder diverticula in patients with Ehlers-Danlos syndrome have been reported in children to cause bladder obstruction.

2. A premature neonate who died of sepsis had a history of urine leakage from the umbilicus. The most likely anomaly to be found on autopsy is

A. Bladder exstrophy  
B. Patent urachus  
C. Urachal cyst  
D. Urachal diverticulum  
E. Urachal sinus

2. B The urachus is the embryological ductal remnant of a connection between the bladder dome and umbilicus. It normally closes around the third trimester and becomes the umbilical ligament. Failure to close completely can result in a variety of anomalies including a urachal sinus, urachal cyst, patent urachus or urachal diverticulum. A patent urachus presents with an open communication between the bladder and the umbilicus. An urachal cyst does not have any opening with either the bladder or the umbilicus. An urachal sinus communicates with either the umbilicus or the bladder but not both. An urachal diverticulum is an outpouching at the dome of the bladder. In bladder extrophy, the bladder communicates directly to the body surface through an anterior abdominal wall defect.


3. Cryptorchidism is

A. A marker of fragile X syndrome.  
B. Associated with congenital adrenal hyperplasia.  
C. Bilateral in most cases.  
D. Often an isolated finding.  
E. Usually due to testicular agenesis or atrophy.

3. D Most cases of cryptorchidism are isolated findings due to undescended testes and rarely due to absent testis (agenesis or atrophy). It is more often to be unilateral than bilateral. Fragile X syndrome and congenital adrenal hyperplasia are associated with macroorchidism.


HEMATOPATHOLOGY

1. Waxy spleen is caused by
A. amyloid
B. lymphoma
C. previous infarction
D. sickle cell disease
E. talc particles

1. A
A spleen involved by amyloid may be grossly normal or show splenomegaly. Deposition takes one of two forms: Sago spleen (deposits limited to the splenic follicles resulting in gross tapioca-like granules) or lardaceous spleen (deposits in the walls of splenic sinuses and connective tissue framework which can coalesce into large, waxy maplike areas of involvement).


2. The inflammatory infiltrate in acute organ rejection is predominantly composed of cells that are:

A. CD3+
B. CD10+
C. CD15+
D. CD20+
E. CD30+

2. A

NEUROLOGY

1. What is second impact syndrome?

A. Blunt trauma secondary to impact injuries from ejection from motor vehicle following primary collision
B. Brain swelling and herniation following a second head injury
C. Hitting a second object after falling from a height
D. It is synonymous with contrecoup brain contusion
E. Myocardial rupture associated with an acute myocardial infarction
1. B  Second impact syndrome results when an athlete (most commonly football players) sustains a head injury, usually resulting in a concussion or cerebral contusion, and then subsequently has another head injury before the symptoms of the first have subsided. The second injury can be very minor and occur up to days or weeks after the first more severe injury. After the second blow, brain swelling ensues because of loss of autoregulation of the brain's blood supply with vascular dilatation within the cranium. There is resultant increased intracranial pressure and brain herniation.


2. A 30-year-old woman had sudden onset of a severe headache. Within an hour, she lost consciousness and died. At autopsy extensive subarachnoid hemorrhage was present. Upon removing this blood from the base of the brain, where are you most likely to find the source of bleeding?

A. At the origin of the anterior communicating artery from the anterior cerebral artery  
B. Vertebral artery at the entrance to the cranial cavity  
C. At the origin of the posterior cerebral artery from the basilar artery  
D. Superior internal carotid artery just above the cavernous sinus  
E. At the convergence of the vertebral arteries to the basilar artery

2. A  Saccular (“berry”) aneurysm is the most common cause of subarachnoid hemorrhage. Patients with autosomal dominant polycystic kidney disease, coarctation and cerebral AV fistulae have an increased risk of intracranial aneurysms. However, berry aneurysms typically occur sporadically and without a consistent relationship to preexisting hypertension or exertion. The most common site of origin is in the anterior circulation of the circle of Willis (90 percent) with 40 percent occurring at the origin of the anterior communicating artery from the anterior cerebral artery.


3. A 50-year-old man had sudden loss of consciousness. A CT scan of the head revealed massive intraparenchymal hemorrhage that was centered in the region of the left basal ganglia. Which of the following is the most common likely cause?

A. AV malformation  
B. Clotting abnormalities  
C. Glioma  
D. Hypertension  
E. Metastatic carcinoma
3. D Hypertension is the most common predisposing factor for intracranial cerebral hemorrhage, accounting for approximately 80 percent of cases. It is thought that hemorrhage results from hypertensive damage to small intracerebral vessels resulting in weakening and dilatation of the vessels. (This is controversial!). Hypertensive intracerebral hemorrhages typically occur deep in the brain, most often in the putamen (50-60 percent), while thalamus, pontine tegmentum, and cerebellum are other common sites. This is in contrast to “lobar” more peripherally located intraparenchymal hemorrhages, which typically are associated to amyloid angiopathy.


4. Following a blow to the head, a 20-year-old man lost consciousness for a few minutes. He was taken to the emergency department of a local hospital where a CT scan of the head showed a lens-shaped collection of blood compressing the right parietal region of the brain. This blood did not appear to cross a suture line and did not interdigitate with the underlying gyri. Which vessel(s) were most likely to have been injured in this case?

A. Bridging veins  
B. Superior sagittal sinus  
C. Small intraparenchymal arteries  
D. Middle meningeal artery  
E) Anterior cerebral artery

4. D Epidural hematomas typically occur as a result of trauma that causes skull fracture in the vicinity of the middle meningeal artery, a penetrating branch of the external carotid artery. The middle meningeal artery and its intradural branches are liable to injury when fracture lines disrupt these vessels resulting in hemorrhage between the dura and skull.


5. Diagnosis of diffuse axonal injury is facilitated by with which special stain?

A. Beta amyloid precursor protein  
B. Congo Red  
C. Mucicarmine  
D. Oil Red O  
E. PAS

5. A

6. A reliable stain for demonstrating intracerebral amyloid is:

A. Abeta
B. Cytokeratin
C. GMS
D. Mucicarmine
E. PAS

6. A


ID/RHEUMATOLOGY

1. A 25-year-old patient with acquired immunodeficiency syndrome (AIDS) died following multiple AIDS-related illnesses, including bacterial pneumonia. What would be the most common bacterial agent causing this patient’s pneumonia?

A. Actinomyces species
B. Hemophilus influenzae
C. Pneumocystis carinii
D. Rhodococcus equi
E. Streptococcus pneumoniae

1. E

Even though AIDS patients are at risk for opportunist infections, failure of the immune system puts them at risk for common bacterial infections as well. The frequency of certain etiologic agents causing bacterial pneumonia is essentially the same in patients with and without human immunodeficiency virus (HIV) infection. Streptococcus pneumoniae, Hemophilus influenzae, and Staphylococcus aureus cause most cases of acute pneumonia in HIV infected individuals, with Streptococcus pneumoniae the cause in the majority of cases. HIV-infected individuals are more likely to have pneumococcal bacteremia (seen in 60% of those with pneumonia) than non-HIV infected patients.

Reference: Lucas GM. Bacterial pulmonary infections in HIV-infected patients. UpToDate, last updated Feb 27, 2014; Literature review current through: Jun 2015.

2. Schaumann bodies are:

A. Another name for the parathyroid glands
B. Aortic paraganglia  
C. Globular plasma cell inclusions  
D. Laminated, calcified proteinaceous concretions seen in sarcoid  
E. Palisading nuclei groupings seen in schwannomas  

2. D  

**PEDIATRICS**

1. A three-month-old infant who had been thriving was found dead in his crib. Parents reported a runny nose and nasal congestion for six days preceding death. What is the most likely diagnosis, based on epidemiological data?

A. Child abuse  
B. *Hemophilus influenzae* bronchopneumonia  
C. Metabolic crisis  
D. Respiratory syncytial virus bronchiolitis  
E. Sudden, unexplained infant death  

1. E  
The definition of sudden, unexplained infant death (SUID) is the sudden death of an infant under one year of age that remains unexplained after thorough case investigation, including (1) performance of a complete autopsy, (2) no gross or microscopic evidence of trauma or significant disease, (3) no evidence of acute or remote trauma on skeletal survey, (4) adequate exclusion of other causes of death including meningitis, sepsis, aspiration, pneumonia, myocarditis, abdominal trauma, dehydration, fluid and electrolyte imbalance, significant congenital malformations, inborn metabolic disorders, carbon monoxide toxicity, drowning and burns, (5) no evidence of acute alcohol or drug intoxication or medication use, (6) thorough death scene investigation and (7) a review of the clinical history. SUID is the most frequent cause of death in infants in the United States. The rate of SUID has decreased in the recent years after public education about sleep patterns and potentially hazardous bedding had been started. However, the lack of uniformity in the way these cases are evaluated and reported must be taken into account before definite conclusions can be drawn.


2. A 4-month-old infant, the product of a normal term birth, was found dead one evening when his mother went to check on him. He had been feeding normally an hour prior to this. The baby had no prior medical problems. What findings would be expected at autopsy in this infant?
A. Laryngeal edema
B. No findings at autopsy
C. Small thymus
D. Subarachnoid hemorrhage
E. Visceral petechiae

2. B  There are no autopsy findings that are specific to sudden, unexplained infant death syndrome (SUID). Thymic, pleural, and/or epicardial petechiae are seen in approximately 80 percent of SUID cases but are non-specific. When other findings are present at autopsy, an alternative diagnosis to SUID should seriously be considered. However death should not be attributed to minor changes that are not a plausible cause of death.


3. Which of the following factors are associated with the highest incidence of sudden, unexplained infant death?
A. Female sex, African american, age 2-4 months, supine sleeping position
B. Female sex, African american, age 4-8 months, prone sleeping position
C. Female sex, white, age 2-4 months, supine sleeping position
D. Male sex, African american, age 2-4 months, prone sleeping position
E. Male sex, white, age 2-4 months, prone sleeping position

3. D  The peak incidence of SUID is at two to four months of age. Male infants have an approximately 50% higher incidence of SUID than female infants. African-American infants tend to have an increased risk, but this may be due to general lower socioeconomic status, which is a well-documented risk factor.

4. Sudden Unexplained Infant Death (SUID) is:
A. Caused by the infant sleeping prone
B. Considered an accidental death
C. A diagnosis that requires autopsy
D. Most commonly seen in white males
E. The sudden unexplained death of a child under 6 months of age

4. C

PULMONARY
A 57-year-old man died following acute increase in shortness of breath ultimately requiring mechanical ventilation. He had noted slowly increasing shortness of breath since a few months. At autopsy his lungs were rather small and firm. The surface of both lower lobes showed a cobblestone pattern. The cut surface revealed firm areas in a peripheral and lower lobe predominant distribution. Many small cysts were identified underneath the pleura arranged in multiple rows. In addition, ill-defined areas of consolidation were identified. Microscopic evaluation most likely showed:

A. Acute bronchopneumonia in a background of bronchiolocentric stellate scars and scattered intraalveolar clusters of smoker’s macrophages.
B. CMV pneumonia in a background of chronic lymphocytic leukemia/small lymphocytic lymphoma.
C. Diffuse alveolar damage in a background of fibrosis with temporal and regional heterogeneity
D. Intraalveolar clusters of smoker’s macrophages expanding alveolar spaces and focal mild interstitial fibrosis.
E. Organizing pneumonia in a background of homogeneous interstitial fibrosis and cellular interstitial pneumonia

1C.
The clinical history together with the gross findings are suggestive of acute exacerbation (AE) of idiopathic pulmonary fibrosis (IPF). Usual interstitial pneumonia (UIP), the morphologic equivalent to idiopathic pulmonary fibrosis, is characterized by temporal and regional heterogeneity of fibrosis. Regional heterogeneity is defined as a “patchwork” distribution of abnormal fibrotic and normal lung parenchyma. Fibrosis occurs predominantly in a peripheral, subpleural distribution. Fibrotic and normal lung parenchyma are identified next or close to each other and both should be seen on the same slide. Temporal heterogeneity describes the presence of mature (collagen) fibrosis with intermixed immature fibrosis and areas without fibrosis. Immature fibrosis is characterized by foci of proliferating fibroblasts, so called fibroblast foci, that appear usually more grey than the surrounding pink mature fibrosis and are often also identified at the interface between fibrotic areas and uninvolved lung parenchyma. The mature fibrosis contains cystic airspaces surrounded by fibrosis/scarring leading to honeycomb changes. Mild patchy chronic inflammation is commonly present within areas of mature fibrosis.

AE of IPF is an unexplained worsening or development of dyspnea in patients with IPF without an identifiable etiology. These patients are usually admitted to the hospital within 30 days from onset of dyspnea. The typical history describes a patient who is being followed for IPF and suddenly develops acute respiratory distress, often accompanied by fever, elevated sedimentation rate, and new pulmonary infiltrates on imaging studies. In some instances, AE constitutes the initial presentation of IPF. The diagnosis of AE of IPF requires the exclusion of infection, underlying collagen vascular disease, abnormal drug reaction, aspiration, pulmonary embolism or congestive heart failure. DAD is the most common morphologic pattern of acute lung injury identified in IPF; OP and prominent fibroblastic foci have also been described.
2. The classic Ghon complex consists of:

A. Apical fibrosis and granulomas adjacent to the transverse fissure  
B. Apical fibrosis and multiple parenchymal granulomas  
C. Granulomas adjacent to the transverse fissure and at the apex  
D. Granulomas adjacent to the transverse fissure and in hilar lymph nodes  
E. Granulomas in hilar lymph nodes and apical fibrosis  

2. D In the classic descriptions of tuberculosis, including that of Ghon, the characteristic complex includes a granuloma at the periphery of the lung in the upper portion of the lower lobe or the lower portion of the upper lobe and a granuloma in a hilar lymph node on the same side.

3. A 66-year-old patient who lived at home with his wife became febrile and ultimately died of sepsis with respiratory insufficiency. At autopsy, the right lung weighed more than 855 g. The cut surface of the right lung revealed consolidation of the lower lobe. There was also patchy consolidation within other lobes. Of the following organisms, the most likely to be the causative agent is:

A. Aspergillus sp.  
B. Pneumocystis carinii  
C. Pseudomonas aeruginosa  
D. Staphylococcus aureus  
E. Streptococcus pneumoniae

3. E Streptococcus pneumoniae is the most common organism that causes community acquired pneumonia. Although the mortality of pneumonia has significantly dropped after the introduction of antibiotics, patients may die from community acquired pneumonia. The mortality rate in the USA/Canada is less than 10%.

4. The only significant gross findings at autopsy of a 24-year-old woman, who was found dead at home were overinflated lungs that could not be deflated after entry into the chest and alternating areas within the lungs of hyperinflation and collapse. Mucus plugs were identified in the small and medium bronchi. What is the most likely cause of death?

A. Asthma  
B. Bronchitis  
C. Bronchopneumonia  
D. Emphysema (Panlobular emphysema)  
E. Pulmonary emboli (Bronchiectasis)

4. A In individuals with asthma, who die unexpectedly, certain key gross findings may be seen. An acute episode of asthma produces mucus plugging of bronchi,
bronchoconstriction, and air trapping. These changes are even more evident in severe asthma and include persistent inflation of lungs after exposure of the lungs during dissection and alternating areas of hyperinflation and collapse due to variable obstruction of the airways. After sectioning, mucus plugs in the small and medium bronchi might also be seen within the lungs. However, all these gross findings are not entirely specific for asthma. Moreover, in some cases, there are no obvious gross findings in lungs of patients who die because of an acute asthma attack and scene investigation is crucial to provide clues to the cause of death.


RENAL

1. Kidneys with petechial hemorrhages, fibrinoid necrosis and “onion-skinning” of the arterioles are characteristic of:

A. Amyloidosis
B. Renal artery stenosis
C. Diabetes mellitus
D. Chronic hypertension
E. Malignant hypertension

1. E
Malignant or accelerated hypertension is associated with petechial hemorrhages on the renal cortical surfaces due to rupture of arterioles or glomerular capillaries. Microscopically, other findings include fibrinoid necrosis of renal arterioles and hyperplastic arteriolitis or onion-skinning of the same vessels.


2. The most likely diagnosis of a renal cortex showing thyroid-like morphology histologically is:

A. Acute tubular necrosis
B. Chronic pyelonephritis
C. Adult polycystic kidney disease
D. Light-chain cast nephropathy (“myeloma kidney”)
E. Diffuse cortical necrosis

2. B
3. Nodular glomerulosclerosis (Kimmelstiel-Wilson disease) and optically clear hepatic nuclei are seen in:

A. Diabetes mellitus
B. Hepatitis C infection
C. Malignant hypertension
D. Polycystic kidney and liver disease
E. Systemic lupus erythematosus

3. A


SOFT TISSUE

1. A 79-year-old woman recovering from a hip fracture in an extended care facility developed what was thought to be a decubitus bed sore. It progressively became more nodular and more exophytic. She developed fatal sepsis. Autopsy included permission to sample the sacral lesion (prior to cremation). This showed a loose myxoid background with zonation from fibrin necrosis to granulation tissue to atypical enlarged fibroblasts with hyperchromatic nuclei, and prominent nucleoli (similar to the ganglion-like cells in proliferative fasciitis). The most likely diagnosis is:

A. Atypical fibroxanthoma
B. Fibrosarcoma
C. Ischemic fasciitis
D. Pyogenic granuloma
E. Well differentiated liposarcoma

1. C  Ischemic fasciitis (atypical decubitus fibroplasia) is a rare pseudo-sarcomatous reactive lesion most often occurring in the elderly. Common sites include bony prominences on dependant areas in bedridden patients and pressure injury is thought to play a role in their etiology.

2. A 34-year-old man died of a drug overdose. His past medical history was significant for colectomy at age 14. At autopsy an 8 cm well circumscribed fibrous mass was found attached to the small bowel mesentery. Microscopically, the mass was comprised of
myofibroblast fascicles, dense collagenous bands, and gaping thin walled vessels. There were also numerous gastric polyps. He most likely has:

A. Albright syndrome  
B. Gardner syndrome  
C. Maffucci syndrome  
D. Marfan syndrome  
E. Osler-Weber-Rendu syndrome

2. B Gardner syndrome is an autosomal dominant disorder associated with mutations in the adenomatous polyposis coli (APC) gene. In addition to gastrointestinal polyps, patients may develop bone osteomas, epidermoid cysts, thyroid tumors, and desmoids. The most common site of desmoid tumors in Gardner syndrome is the abdominal wall (rectus abdominis aponeurosis), but they may also arise in the mesentery, breast, or soft tissues.

3. A 73-year-old obese man with prior coronary bypass surgery died at home from a cardiac arrhythmia. At autopsy, a 22 cm fatty mass was discovered overlying the left kidney in the retroperitoneum. A focal area of the mass is more fleshy-appearing and microscopically shows a pleomorphic spindle cell morphology with high mitotic activity. Sections from the rest of the lesion show occasional enlarged hyperchromatic adipocytes. The most likely diagnosis is:

A. Dedifferentiated liposarcoma  
B. Fibrosarcoma  
C. Myelolipoma  
D. Pleomorphic high grade sarcoma  
E. Rhabdomyosarcoma

3. A Dedifferentiated liposarcoma is a malignant adipocytic neoplasm arising in transition from a typical lipomatous tumor. They typically arise in the same sites as well differentiated liposarcomas/atypical lipomatous tumors (retroperitoneum, spermatic cord, trunk, head and neck, and deep soft tissues. The diagnosis can be confirmed by assessing for MDM2 gene amplification.

BONUS

GENERAL – HISTORICAL

1. The birth of anatomic pathology and the first major published series of cases to correlate clinical histories with autopsy findings is attributed to:

A) Francis Bacon  
B) William Harvey
C) Hippocrates
D) Giovanni Morgagni
E) Rudolf Virchow

1. D


2. Who introduced the concept of the "posthumous analysis", an approach that treats autopsies like large surgical specimens and focuses on selective tissue sampling and rapid turnaround time?

A. Ackerman
B. Anderson
C. Haber
D. Rosai

2. D


3. Who developed the first complete and systematic method of postmortem examination, and personally performed more than 30,000 autopsies?

A. William Hunter
B. Giovanni Morgagni
C. William Osler
D. Karl Rokitansky
E. Rudolf Virchow

3. D