BCEN CBRN - Quiz Questions with Answers

1. Pathophysiology

1.

Which of the following statements is accurate about the organic healing of burn wounds (without operation)?

Superficial partial-thickness burns usually heal within 2 weeks without scarring

Deep partial-thickness burns will heal within 3 weeks and will predictably scar

Full-thickness burns will take many weeks to heal and will predictably scar

Superficial partial-thickness burns will heal in 3-4 days without scarring

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Correct answer: Superficial partial-thickness burns usually heal within 2 weeks without scarring

With appropriate wound care, superficial dermal burns (superficial second-degree burns), which extend into the papillary dermis and characteristically form blisters, will heal within 2 weeks without risk of scarring. Therefore, these burn injuries do not require surgical intervention and management.

Superficial (first-degree) burns will heal in 3-4 days without scarring. Deep partial-thickness, or deep dermal, burns (deep second-degree burns) extend into the reticular dermis and generally take more than 3 weeks to heal. Most deep partial-thickness burns that have not healed by 3 weeks should be excised and grafted. Scarring is likely. Full-thickness burns (third-degree burns) require grafting and should undergo early excision and grafting to minimize infection and hypertrophic scarring and to expedite patient recovery. Healing time varies depending on how the patient tolerates surgical interventions.

2.

The process of collagen synthesis occurs mainly in the cells of which structure?

Fibroblasts

Platelets

Macrophages

Neutrophils

Correct answer: Fibroblasts

Collagen is the major constituent of the extracellular matrix (ECM) and provides a scaffold for cells and mechanical strength for tissues. In postburn hypertrophic scars (HTS), the quantity of collagen per unit surface area is increased. Fibroblasts are specialized cells that synthesize collagen.

3.

What is thought to be the leading cause of mortality in fire victims?

Carbon monoxide toxicity

Pulmonary edema

Hypovolemic shock

Cardiovascular collapse

Correct answer: Carbon monoxide toxicity

When flames engulf a room, they consume oxygen and reduce the fraction of inspired oxygen (FIO_2) in the room to <10%, causing tissue hypoxia and asphyxia. Carbon monoxide (CO) toxicity is a frequent cause of morbidity and mortality in patients who sustain smoke-induced inhalation injury. Smoke from the fire will reach a victim before the flames can, which can lead to suffocation and death.

Cardiovascular collapse and hypovolemic shock can affect any burn-injured patient and are not specific to fire victims. Pulmonary edema is not a major complication for fire victims.

4.

Which of the following factors is not a component of the lethal trauma triad in burn shock patients?

Hyperglycemia

Coagulopathy

Hypothermia

Acidosis

Correct answer: Hyperglycemia

*The goals of treating traumatic shock are to restore perfusion and tissue oxygenation and to prevent the development of the life-threatening triad, which includes the trinity of **hypothermia, acidosis, and coagulopathy**. This is known as the lethal triad in a trauma setting and is a well-known risk factor associated with a high risk of death.*

Hyperglycemia is not a component of this deadly trauma triad.

5.

The skin is composed of the epidermis and the dermis, with each layer containing multiple types of cells. Which cell type is found predominantly in the epidermis?

Keratinocytes

Mast cells

Macrophages

Neutrophils

Correct answer: Keratinocytes

The epidermis (outermost layer) and dermis (innermost layer) are separated by the basement membrane. Beneath the dermis is a layer of loose connective tissue called the hypodermis, or subcutis.

The epidermis varies in thickness, has no blood supply of its own, and is composed of several layers of cells, 90% of which are keratinocytes (synthesize keratin). The dermis is the thickest tissue layer of the skin. Dermal cells include mast cells, neutrophils, macrophages, and lymphocytes.

6.

You are caring for a severely burned patient who has an AB blood type and requires a blood transfusion. Which red blood cells (RBCs) are compatible?

O, A, B, and AB

O and B

O and A

Only O

Correct answer: O, A, B, and AB

There are eight different blood types, which are defined by the presence or absence of certain antigens. If a patient has an AB blood type, they are compatible with red blood cells O, A, B, and AB.

Blood type A is compatible with O and A red blood cells, and blood type B is compatible with O and B red blood cells. Type O is considered the "universal donor," which means these patients can donate to anyone.

7.

What are the first inflammatory cells to reach a burn site injury?

- **Leukocytes**
- Platelets
- Macrophages
- Fibroblasts

Correct answer: Leukocytes

Leukocytes are a key player in the inflammatory phase of wound healing. They are the first inflammatory cells to reach the site of injury and depend on oxygen for effective phagocytosis.

Leukocytes escape the vasculature and enter the tissues, causing edema. They migrate from inside the blood vessels to the site of injury. These effects can be visible within seconds but are relatively short-lived.

8.

What is the most prevalent type of burns in adults admitted to burn centers in the USA?

Flame and flash burns

Scald burns

Contact burns

Chemical burns

Correct answer: Flame and flash burns

Flash and flame burn injuries represent approximately 40% of the admissions to American regional burn centers and are a major source of morbidity and mortality across all age groups. Scald burn injuries (hot water) are the second most common cause of burns in adults in the USA and the most common cause of burns in children under the age of four years. Hot water scalds represent approximately one-third of cases.

Contact and chemical burns are less common types of burn injuries.

9.

Which of the following is not an indication of early intubation for a burn patient?

The suspicion of an inhalation injury (either upper or lower)

The presence of >30% TBSA burn injury

An elevated carboxyhemoglobin level >10%

A decreased level of consciousness (DLOC)

Correct answer: The suspicion of an inhalation injury (either upper or lower)

Although suspicion of an inhalation injury is often enough of an indication for intubation, not all patients exposed to smoke will require intubation. Close observation of these patients with preparation to intervene immediately is prudent.

Patients with evidence of upper or lower airway and lung injury (e.g., an elevated carboxyhemoglobin level >10%, stridor, or hoarseness) should be promptly intubated. Another major indication for early intubation in burn patients is the presence of a large TBSA burn injury. While there is no mandatory cut-off for TBSA above which intubation is necessary, 30% TBSA is the cut-off recommended by Acute Burn Life Support. A last indication for intubation is a DLOC. These patients should be immediately intubated, and a thorough work-up should be initiated.

10.

Using the qSOFA score, which of the following assessment data would be positive for sepsis in a burn-injured patient?

GCS = 12, BP = 90/52, RR = 25/min

GCS = 10, HR = 120, RR = 22/min

Lactate = 3 mmol/L, WBC = 12,000/mm^3, temperature = 39 °C (102.2 °F)

Lactate = 4.5 mmol/L, HR = 112, BP = 89/45

Correct answer: GCS = 12, BP = 90/52, RR = 25/min

Although many scoring systems exist for sepsis, the sequential organ failure assessment (SOFA) score has good predictive validity and is recommended for quantifying organ dysfunction associated with sepsis in critically ill patients.

An abbreviated easy-to-use version of the SOFA score called the qSOFA is often used. It is positive if 2 or more of the following indicators are present:

- *systolic blood pressure ≤100 mm Hg*
- *respiratory rate ≥22/min*
- *altered mental status (Glasgow Coma Scale score <15)*

11.

Which water-soluble vitamin is helpful for collagen synthesis?

Vitamin C

Vitamin A

Vitamin E

Vitamin B complex

Correct answer: Vitamin C

Vitamins B and C are water-soluble. Vitamin C is essential for collagen synthesis, while vitamin B is necessary for the production of energy from glucose, amino acids, and fat.

Vitamins A, D, E, and K are fat-soluble. While vitamins A and E are also helpful for collagen formation, they are not water-soluble.

12.

Upon assessment of a burn injury on your patient's right lower extremity, you note red granulation tissue. The wound edges are firm and soft, and the wound is beginning to contract into a rectangular shape. Which of the following phases of wound healing is this?

Proliferation

Inflammation

Maturation

Hemostasis

Correct answer: Proliferation

The third phase of acute full-thickness wound healing is the proliferative phase. Signs of acute proliferation indicate a healthy response and normal healing. During this phase, peri-wound skin regains color and contour symmetry with that of adjacent skin (i.e., edema is resolved). Granulation tissue starts to form at the wound perimeter, contracting the wound, and reepithelialization results in scar formation.

Hemostasis occurs immediately as platelets seal the vessels and the clotting cascade begins. Inflammation—the second phase of wound healing—is characterized by erythema and edema as phagocytosis removes debris. Maturation (or remodeling) is the final stage of wound healing, as the scar continues to form and the wound closes. This phase can continue for up to two years as the underlying tissue continues to remodel.

13.

During burn wound healing, angiogenesis is stimulated by all the following factors, except:

Angiostatin

Lactic acid

Hypoxia

Heparin-binding epidermal growth factor

Correct answer: Angiostatin

The wound healing process is often described as four overlapping phases of healing:

1. *Hemostasis*
2. *Inflammation*
3. *Proliferation (angiogenesis occurs in this phase)*
4. *Remodeling*

The tissue response has several major components, including angiogenesis, which is the growth of new blood vessels. Through angiogenesis and other tissue responses, the process of wound healing is initiated, directed, and finally completed.

Vascular endothelial growth factor (VEGF), otherwise known as vascular permeability factor, is secreted by keratinocytes in response to hypoxia. It increases in wound healing and is responsible for stimulating angiogenesis. Lactic acid and heparin-binding epidermal growth factor also stimulate angiogenesis.

Angiostatin is an inhibitor of angiogenesis.

14.

Which of the following best describes eschar?

Devitalized tissue

Viable tissue

Fibrin

Granulation tissue

Correct answer: Devitalized tissue

Eschar is necrotic, devitalized, or nonviable tissue. This tissue is black or brown and can be loose or firmly adherent; it may be hard, soft, or boggy. Eschar can impair healing and inhibit keratinocyte migration over the wound bed.

15.

A full-thickness burn injury is best characterized by which of the following descriptions?

Dry and leathery wound surface, marked tissue edema, no pain to touch

Moist wound surface, broken blisters, minimal to moderate edema, painful to touch

No blisters, minimal tissue edema, painful to touch, moist wound surface

Erythematous wound surface, no pain to touch, marked tissue edema

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Correct answer: Dry and leathery wound surface, marked tissue edema, no pain to touch

In full-thickness (third-degree) burns, thermal injury extends deep enough to destroy all the hair follicles that have the capacity to regenerate the epidermis, and some of the upper subcutaneous tissue may also become necrotic. Their appearance may be charred, leathery, dry, firm, and depressed when compared to adjoining normal skin. They will not blanch to the touch or be sensate or painful. It is still possible to elicit pain because manipulation of a full-thickness burn may stimulate the edges of the burn, which is inflamed with marked tissue edema and sensate.

Most full-thickness burns should undergo early excision and grafting to minimize infection and hypertrophic scarring and to expedite patient recovery.

16.

Which of the following statements is accurate regarding tissue injury and the body's immunologic response?

The pathophysiologic effects related to a burn injury are both local and systemic

Circulatory compromise is greatest 24 to 72 hours after a burn is sustained

Activation of the stress response causes severe respiratory acidosis and hypoxemia

The main goal of therapy is to restore microcirculatory perfusion of tissues

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Correct answer: The pathophysiologic effects related to a burn injury are both local and systemic

Any burn injury greater than 20% TBSA involves acute inflammatory processes that are both local and systemic; microcirculatory compromise is greatest at 12 to 24 hours post-burn injury. Activation of the stress response causes mild respiratory alkalosis and hypoxemia, which are complicated by increased pulmonary capillary permeability. The result is decreased lung compliance and decreased respiratory function.

There are two goals of therapy: to restore microcirculatory perfusion of tissues and to control the exaggerated inflammatory cytokine cascade response.

17.

Slough can be described as which of the following?

Necrotic tissue

Viable tissue

Granulation tissue

Collagen

Correct answer: Necrotic tissue

Slough is soft, moist, avascular (nonviable) tissue (necrotic/devitalized). It may be white, yellow, tan, or green and loosely or firmly adherent to the wound bed. It consists of fibrin debris and has a moderate to high water content. Necrotic tissue can impair healing and impede keratinocyte migration over the wound bed.

Granulation tissue is pink/red moist tissue composed of new blood vessels, connective tissue, fibroblasts, and inflammatory cells that fill an open wound when it starts to heal. Granulation tissue typically appears deep pink or red with a granular surface that is berry-like or cobblestoned.

18.

Circumferential burns of the extremities can produce a tourniquet-like effect and lead to which of the following complications?

Compartment syndrome

Sepsis

Pulmonary insufficiency

Neuropathic pain

Correct answer: Compartment syndrome

Compartment syndrome occurs when pressure builds within the muscles to dangerous levels. Special consideration should be given to burns that are completely circumferential around a part of the body, such as a limb or the trunk. These types of wounds can cause increased pressure if tissue beneath the wound becomes edematous, resulting in vascular compromise (compartment syndrome) and leading to ischemia.

19.

What primarily occurs during the first phase of wound healing?

Clotting

Granulation

Inflammation

Angiogenesis

Correct answer: Clotting

There are four primary phases of wound healing:

1. *Hemostasis (vascular): platelets seal the bleeding vessels, and thrombin is produced to stimulate the clotting mechanism.*
2. *Inflammatory: inflammation occurs (erythema and edema along with pain) as the blood vessels release plasma and neutrophils to begin phagocytosis to remove debris and prevent infection.*
3. *Proliferative/granulation (fibroblastic): fibroblasts produce collagen to provide support, and granulation tissue starts to form.*
4. *Maturation (differentiation, remodeling, or plateau): fibroblasts leave the wound, and collagen tightens to reduce scarring.*

20.

You are caring for a patient with a deep full-thickness burn injury who is exhibiting signs of bloodstream sepsis. Which clinical finding is not consistent with sepsis diagnostic criteria?

Hypoactive bowel sounds

Temperature of 101.5 °F (38.6 °C)

Heart rate of 99 beats/min

Urine output 40 mL/hr

Correct answer: Hypoactive bowel sounds

Sepsis diagnostic criteria with regard to signs and symptoms include the following:

- *Fever (temperature >100.9 °F [38.3 °C]) or hypothermia (core temperature <97 °F [36 °C])*
- *Tachycardia (heart rate >90 beats per minute)*
- *Tachypnea (respiratory rate >22 breaths per minute)*
- *Systolic blood pressure (SBP) ≤100 mm Hg*
- *Altered mental status (Glasgow Coma Scale score <15)*
- *Edema or positive fluid balance*
- *Oliguria (≤30 mL/hr)*
- ***Ileus (absent bowel sounds)***
- *Decreased capillary refill or mottling of skin*

21.

You are caring for a burn patient who is experiencing shock and develops a central venous pressure (CVP) of 2 mm Hg. Which intervention should you implement first?

Increase the rate of intravenous (IV) fluids

Obtain arterial blood gases (ABGs)

Increase the rate of supplemental oxygen flow

Administer intravenous (IV) morphine

Correct answer: Increase the rate of intravenous (IV) fluids

The CVP is low for this patient, indicating a rapidly decreasing circulating volume and inadequate tissue perfusion. Frequent adjustments of infusion rates to balance individual changes in physiology are needed for each patient; in this scenario, fluid volume needs to be increased to provide adequate perfusion. This is the first priority.

Increasing the oxygen flow rate, obtaining ABGs, and providing pain relief may be necessary interventions, but perfusion via restoring fluid volume is the first priority.

22.

Which of the following layers of epidermis is not always present in the skin?

Stratum lucidum

Stratum corneum

Stratum granulosum

Stratum basale

Correct answer: Stratum lucidum

The epidermis is the outermost layer of the skin and consists of the stratum basale, spinosum, granulosum, and corneum. The epidermis provides a vapor and bacterial barrier and is constantly renewing from its basal layer, with new keratinocytes undergoing terminal differentiation over approximately 4 weeks.

The stratum lucidum is directly below the stratum corneum and is found in areas where the epidermis is thicker (soles of the feet and palms of the hands). It is absent from thinner skin, such as the eyelids.

23.

A burn wound to an abdomen that is left open to allow for granulation and healing is considered which type of wound healing?

Secondary intention

Primary intention

Tertiary intention

Quaternary intention

Correct answer: Secondary intention

Wounds that heal by secondary intention do so through granulation tissue formation, contraction, and epithelial migration. These wounds are left open or possibly packed and dressed to allow for granulation and healing.

Healing by primary intention involves suturing a wound closed, and tertiary intention healing involves delayed closure or possible skin grafting.

24.

A burn-injured patient exhibits signs and symptoms of hypoxia upon admission to the emergency department (ED). Which of the following assessment findings is not an indication of hypoxia?

Bradypnea

Tachypnea

Dyspnea

Tachycardia

Correct answer: Bradypnea

Bradypnea is an indication of hypercapnia, not hypoxia. Hypercapnia occurs when carbon dioxide is increased in the blood. Retained carbon dioxide decreases the respiratory drive, leading to slowed breathing.

Hypoxia occurs when oxygen is decreased in the tissues and causes an increased respiratory rate. Restlessness, tachycardia, tachypnea, and dyspnea are all indications of hypoxia.

25.

Which of the following positions may be helpful for a burn patient who is beginning to exhibit signs of hypovolemic shock?

Supine with legs elevated

Semi-Fowler with legs elevated

Trendelenburg position

Sims position

Correct answer: Supine with legs elevated

Multiple nursing interventions may be implemented for burn patients experiencing shock. To promote venous return to the right side of the heart and improve cardiac output, a patient should initially be placed in a supine position with the legs elevated higher than the level of the heart.

The Trendelenburg position is not recommended for shock, as it increases intracranial pressure. A reverse-Trendelenburg position, however, may be useful. Semi-Fowler and Sims positions will not promote venous return to the right side of the heart.

26.

Which of the following is not a function of macrophages?

Controlling vasodilation of blood vessels

Phagocytosis

Cell recruitment and activation

Angiogenesis

Correct answer: Controlling vasodilation of blood vessels

Monocytes are early cells that infiltrate the wound site, and they undergo phenotypic changes into macrophages. Macrophages can be regarded as the "master cells" involved in wound healing because of their central role in phagocytosis, inflammatory cell recruitment and activation, systemic inflammation, and angiogenesis.

Mast cells control vasodilation of blood vessels, which also increases permeability; this causes redness, pain, and warmth at the wound site.

27.

You overhear a physician stating that a burn patient you are caring for, diagnosed with disseminated intravascular coagulation (DIC), requires a transfusion. Which blood product should you anticipate administering?

Cryoprecipitate

Platelets

Albumin

Packed red blood cells

Correct answer: Cryoprecipitate

Cryoprecipitate is useful in treating bleeding from DIC because it is rich in clotting factors.

Albumin may be used as a plasma expander in hypovolemia with or without shock. Platelet-rich plasma (PRP) is used when the patient's platelet count is low. Packed red blood cells replace erythrocytes, not fibrinogen.

28.

A 50-year-old female presents after suffering extensive burn injuries in a house fire. Her burns are deep and involve more than 30% of her total body surface area (TBSA). She is experiencing fever, tachycardia, and increased respiratory rate.

Which condition is this patient most likely developing in response to her burn injuries?

Systemic inflammatory response syndrome (SIRS)

Hypovolemic shock

Anaphylactic shock

Sepsis

Correct answer: Systemic inflammatory response syndrome (SIRS)

The patient's symptoms of fever, tachycardia, and increased respiratory rate suggest SIRS, a systemic inflammatory response that can occur as a result of severe burn injuries. Two or more of the following conditions must be present for the diagnosis of SIRS to be made:

- *Temperature >38 °C or <36 °C*
- *Heart rate >90 beats/min*
- *Respiratory rate >20 min or a $PaCO_2$ <32 mm Hg*
- *Leukocyte count >12,000 cells/mm^3, <4,000 cells/mm^3, or >10% immature (band) forms*

Sepsis is the systemic response to infection and is defined as the presence of SIRS in addition to a documented or presumed infection. These symptoms are not indicative of hypovolemic or anaphylactic shock.

29.

Certain risk factors have an increased association with multiple organ dysfunction syndrome (MODS) in a burn-injured patient. Possible factors include all the following, except:

Female sex at birth

Age 50 years or older

Infection

Full-thickness burn >30% TBSA

Correct answer: Female sex at birth

All the following factors place a burn patient at an increased risk of developing MODS:

- *Age 50 years or older*
- *Inhalation injury*
- *Full-thickness burn of 30% or greater TBSA*
- *Male sex at birth*
- *Infection (sepsis)*

30.

What are the most important cells in the proliferative phase of wound healing?

Fibroblasts

Endothelial cells

Epithelial cells

Keratinocytes

Correct answer: Fibroblasts

The proliferative phase of wound healing is characterized by the formation of granulation tissue, reepithelialization, and neovascularization. In order for wound contraction to occur, fibroblasts form networks within the dermis that allow the wound to contract. They are the most important cells in this phase.

Vascular endothelial cells help with neovascularization. Keratinocytes and epithelial cells help with the epithelialization process.

31.

A systemic capillary leak due to mediators released at the burn site occurs in all burns above what size?

15-20% TBSA

20-30% TBSA

10-15% TBSA

30% TBSA

Correct answer: 15-20% TBSA

Any injury causes edema due to the release of local mediators, which increase vasodilation and vascular permeability in order to allow the delivery of factors that assist in fighting infection and initiating wound healing. The many mediators that participate in permeability changes suggest that there is significant redundancy in the system.

Any burn injury covering more than 15-20% TBSA will cause a systemic capillary leak from mediators released at the burn site, which can lead to burn shock from massive fluid shifts unless fluid resuscitation is promptly initiated.

32.

Gram-negative bacteria that commonly cause burn wound infections include all the following, except:

Haemophilus influenzae

Pseudomonas aeruginosa

Klebsiella pneumoniae

Escherichia coli

Correct answer: Haemophilus influenzae

Bacteria can colonize a burn wound within 48 hours of injury and cause infection. Common gram-negative pathogens that are responsible for wound infection (which could lead to sepsis if not promptly identified and treated) include P. aeruginosa, K. pneumoniae, and E. coli. Gram-positive pathogens that can infect burn areas include Staphylococcus aureus and coagulase-negative streptococci.

H. influenzae, commonly found in respiratory tract infections, is not a typical pathogen of burn wound infections.

33.

What layer of skin helps regulate body temperature?

- **Dermis**
- Epidermis
- Hypodermis
- Fascia

Correct answer: Dermis

The dermis lies between the epidermis and the subcutaneous tissue. It consists of connective tissue with fibrous proteins (collagen and elastin) and nourishes the epidermis through its rich supply of vascular and lymphatic structures.

The dermis prevents desiccation of the skin by producing oils, and the reactive dermal microvasculature facilitates heat dissipation and conservation, assisting in the regulation of body temperature.

34.

A severely burned patient requires a massive blood transfusion. You know that citrate can accumulate in this patient's circulation and lead to toxicity, potentially causing which of the following abnormalities?

Hypocalcemia

Hypercalcemia

Hypokalemia

Hyperkalemia

Correct answer: Hypocalcemia

Citrate is universally used as an anticoagulant in the storage of blood because of its ability to bind calcium, which is required for the activation of the coagulation cascade. During a massive transfusion, however, excessive citrate in transfused blood can result in a fall in ionized calcium. Hypocalcemia can lead to hypotension, reduced cardiac function, cardiac arrhythmias, and clotting abnormalities.

Nursing care should include monitoring ionized calcium, particularly if hemodynamic instability is present in a hypocalcemic patient.

35.

A patient in the emergent phase of burn care would exhibit all the following laboratory values, except:

Decreased hematocrit

Hyponatremia

Hyperkalemia

Hyperglycemia

Correct answer: Decreased hematocrit

When plasma leaves the intravascular system, it causes the blood to become more concentrated (hemoconcentration), so hematocrit increases with burn injury. Once fluid resuscitation is started and the fluid is replaced within the body, hematocrit will decrease.

A patient in the emergent phase of burn care will often exhibit low sodium, high potassium, and high serum glucose.

36.

Which of the following cells is responsible for wound contraction?

Myofibroblasts

Fibroblasts

Epithelial cells

Keratinocytes

Correct answer: Myofibroblasts

Wound contraction force comes from myofibroblasts located in a centrally granulating mass; myofibroblasts are the primary cells present in the granulation tissue of contracting wounds. They are key cells for connective tissue remodeling, which takes place during wound healing and fibrosis development. Contraction may account for 50-70% of wound closure.

37.

What types of collagen are seen in the dermis during wound healing?

Types I and III

Types I, II, and III

Types II and III

Types I and II

Correct answer: Types I and III

In normal skin, the majority of collagen is type I (80%) with smaller amounts of type V. During normal wound healing, types I and III are predominantly seen in the dermis. Type III collagen appears early and gradually disappears as the scar is remodeled and matures.

38.

Recovery of a burn injury involves successful passage through three phases of burn care. Which of the following is not one of these three phases?

Progressive

Emergent

Acute

Rehabilitative

Correct answer: Progressive

Burn management can be divided into three phases: resuscitative/emergent, acute, and rehabilitative/reconstructive.

Principles of care for the emergent/resuscitative period involve the resolution of the immediate problems resulting from the burn injury. The time required for this to occur is usually 24 to 48 hours. Principles of care for the acute (or wound management) period include avoidance, detection, and treatment of complications and wound care. This phase ends when the majority of burn wound(s) have healed. The final phase of rehabilitative care involves the patient returning to an optimal place in society and accomplishing any remaining functional and cosmetic reconstruction.

39.

Which of the following statements is accurate regarding inhalation injury survivors?

Most survivors of inhalation injury have clinically normal long-term lung function

Patients with inhalation injuries usually have an abnormal gas exchange for 48-72 hours after injury

The immediate life-threatening consequence of inhalation injury is lower airway edema

Technetium scanning is a widely adopted technique to confirm the clinical diagnosis and to stratify the severity of the injury

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Correct answer: Most survivors of inhalation injury have clinically normal long-term lung function

Long-term lung function is clinically normal for inhalation injury survivors.

The immediate life-threatening consequence of inhalation injury is upper airway edema. Bronchospasm can develop immediately after inhalation injury but is usually responsive to inhaled beta-agonist agents. Gas exchange is usually normal for the first 48-72 hours post-injury until a slough of endobronchial debris occurs. Fiberoptic bronchoscopy may be used to support the diagnosis. While technetium scanning has been used to confirm the diagnosis, it has not been widely adopted and does not stratify severity.

40.

Most commonly, patients with carbon monoxide (CO) poisoning will present with which symptom?

Headache

Tachycardia and tachypnea

Dizziness and weakness

Hypotension

Correct answer: Headache

The severity of clinical manifestations varies depending on CO concentration. Headache is the most common presenting symptom of carbon monoxide toxicity, occurring when blood carboxyhemoglobin (COHb) levels are 20-40%.

Dizziness, weakness, and nausea are other common presenting findings. The cardiovascular manifestations may result in tachycardia, increased cardiac output, dysrhythmias, myocardial ischemia, and hypotension, depending on the severity of the poisoning.

2. Clinical Practice: Initial Management (<72 hours)

41.

A 22-year-old male patient has partial-thickness burns to both of the posterior arms, anterior and posterior of the trunk, and posterior head and neck.

Using the Rule of Nines, calculate the total body surface area (TBSA) percentage that is burned.

49.5%

63%

31.5%

54%

Correct answer: 49.5%

According to the Rule of Nines, the posterior right arm is 4.5%, and the posterior left arm is 4.5%. The anterior trunk accounts for 18%, and the posterior trunk is also 18%. Finally, the posterior head and neck are 4.5%. This totals 49.5% TBSA burned.

42.

During the resuscitative phase of burn injury, thermoregulation is a major challenge secondary to tissue loss and rapid fluid resuscitation. Hypothermia can lead to all the following, except:

Lower cardiac output by up to 50%

Impair neutrophil function, increasing the risk of infection

Impair platelet function, increasing the risk of bleeding

Impair microcirculatory perfusion

Correct answer: Lower cardiac output by up to 50%

Maintaining normothermia is a priority during the early stages of burn care. Evaporative fluid loss from tissue loss and rapid fluid resuscitation can cause hypothermia, which can:

- *impair microcirculatory perfusion*
- *induce shivering, which exacerbates hypermetabolism*
- *impair neutrophil function, increasing the risk of infection*
- *Impair platelet function, increasing the risk of bleeding*
- *lower cardiac output by up to 25%*
- *cause low levels of magnesium, potassium, and calcium*

43.

When a burn patient receives fluid resuscitation, over-administration of potassium in an effort to correct hypokalemia can lead to dangerous cardiac arrhythmias. These are often preceded by which of the following findings on electrocardiogram (ECG)?

Peaked T-waves

Shortened PR interval

ST-segment elevation

Shortened QRS duration

Correct answer: Peaked T-waves

Significant hypokalemia and hypophosphatemia are common during the first days following resuscitation in burn-injured patients. While these should be monitored and supplemented, it is important not to overcorrect. Overcorrection of hypokalemia (and subsequent hyperkalemia) is particularly dangerous, as it can lead to cardiac arrhythmias, including asystole. These are often preceded by large peaked T-waves on the ECG.

Other ECG changes indicative of hyperkalemia include a flattened P wave, prolonged PR interval, ST depression, and prolonged QRS duration.

44.

To obtain a pediatric trauma patient's history, the Emergency Nurses Association (ENA) recommends using which of the following assessment strategies?

CIAMPEDS

OPQRST

AMPLE

ABCDE

Correct answer: CIAMPEDS

During the early evaluation of a child who has sustained trauma, obtaining and documenting a thorough history can provide key insight into the potential nature and severity of the injury and can assist in formulating a plan of care. The ENA recommends using the CIAMPEDS mnemonic:

- ***C**: Chief complaint*
- ***I**: Immunizations/isolation*
- ***A**: Allergies*
- ***M**: Medications*
- ***P**: Past medical history*
- ***E**: Events surrounding the illness or injury*
- ***D**: Diet*
- ***S**: Symptoms associated with the illness or injury*

45.

A 68-year-old female patient has deep partial-thickness burns to the anterior and posterior right and left legs, the posterior left arm, and the posterior trunk.

Using the Rule of Nines, calculate the total body surface area (TBSA) percentage that is burned.

58.5%

63%

49.5%

40.5%

Correct answer: 58.5%

According to the Rule of Nines, the entire right leg is 18% (front and back), the entire left leg is 18% (front and back), the posterior left arm is 4.5%, and the posterior trunk is 18%. This totals 58.5% TBSA burned.

46.

The initiation of prophylactic anticoagulation therapy for prevention of deep vein thrombosis (DVT) for a burn-injured patient is recommended within what timeframe?

The first 72 hours post-injury

The first 24 hours post-injury

The first 48 hours post-injury

The first 12 hours post-injury

Correct answer: The first 72 hours post-injury

Burn wounds create a hypercoagulable state within the body due to the procoagulant effects created by the release of tissue thromboplastin and subendothelial collagen. This places the patient at high risk of thromboembolism formation. Adding to this, any immobilized patient is going to be at an increased risk for deep vein thrombosis (DVT) formation.

Since prevention is key to DVT management, prophylactic anticoagulation therapy (with low-molecular-weight heparin [LMWH] or heparin if LMWH is contraindicated) should be initiated within the first 72 hours post burn injury).

47.

You are triaging a burn victim with multiple trauma after a motor vehicle crash in which the vehicle caught on fire. The patient is developing acute respiratory distress syndrome (ARDS) as evidenced by which of the following early signs?

Tachypnea

Intercostal retractions

Inspiratory crackles

Cyanosis

Correct answer: Tachypnea

The earliest detectable sign of ARDS is an increased respiratory rate, which can begin from 1 to 96 hours after initial injury to the body. This is followed by increasing dyspnea, air hunger, nasal flaring, retractions, and cyanosis. Breath sounds may be clear or consist of fine inspiratory crackles or diffuse coarse crackles.

48.

You are caring for a patient in the emergent/resuscitative phase of a burn injury and are drawing labs. Upon analysis of the patient's laboratory studies, you expect the results to indicate all the following, except:

Metabolic alkalosis

Elevated hematocrit

Hyperkalemia

Hyponatremia

Correct answer: Metabolic alkalosis

Fluid and electrolyte changes in the emergent/resuscitative phase of a burn injury include hyperkalemia related to the release of potassium into the extracellular fluid, hyponatremia from significant sodium lost in trapped edema fluid, hemoconcentration that leads to an increased hematocrit, and loss of bicarbonate ions that results in metabolic acidosis.

49.

A burn-injured patient with circumferential burns to both extremities and a femur fracture to the left leg reports calf pain in the unaffected (right) leg. After you ensure a patent airway, what intervention is the next priority?

Assess neurovascular status

Massage the calf

Apply ice to the leg

Elevate the extremity

Correct answer: Assess neurovascular status

This assessment finding is consistent with deep vein thrombosis (DVT). Burn wounds create a hypercoagulable environment due to the procoagulant effects created by the release of subendothelial collagen and tissue thromboplastin, leading to a high risk of venothromboembolism (VTE) and pulmonary embolus. Other clinical features of DVT include increased or unequal lower extremity girth, redness or warmth, and body temperature elevation.

Once the airway is managed, a neurovascular assessment is necessary to assess pulse, color, and sensation to intervene rapidly. Massaging the calf is contraindicated, as this could disturb or dislodge a DVT. Applying ice is inappropriate and ineffective. The extremity should be elevated, but the priority in this scenario is to assess the patient's neurovascular status.

50.

You are caring for a patient admitted with approximately 40% TBSA burns from a house fire. You note the patient becoming increasingly restless and agitated 8 hours after admission. What is your priority nursing intervention?

Check oxygen saturation using pulse oximetry

Assess level of consciousness (LOC) and orientation

Administer ordered morphine intravenously

Draw arterial blood gases (ABGs)

Correct answer: Check oxygen saturation using pulse oximetry

For a patient who was in a house fire, inhalation injury is likely. The immediate life-threatening consequence of inhalation injury is upper airway edema, sometimes shown by agitation and restlessness as the patient becomes hypoxic. Airway management is always the priority, so oxygen saturation should be assessed first. The treatment of inhalation injury primarily consists of supportive care to maintain a patent airway for oxygenation and ventilation while the lungs heal.

Assessing LOC and orientation is also an appropriate intervention but does not take precedence over determining whether the patient is hypoxemic. If you determine that the reason for the restlessness and agitation is pain-related, then morphine administration would be appropriate. ABGs may need to be drawn after checking oxygen saturation levels.

51.

A 42-year-old male patient has superficial partial-thickness burns to the posterior head and neck, entire right arm, back of the left arm, posterior trunk, entire left leg, and posterior right leg. Using the Rule of Nines, what total body surface area (TBSA) percentage is burned?

63%

54%

45%

72%

Correct answer: 63%

According to the Rule of Nines, the posterior head and neck account for 4.5%, the entire right arm is 9% (front and back), the back of the left arm is 4.5%, the posterior trunk is 18%, the entire left leg is 18% (front and back), and the posterior right leg is 9%. This totals 63% TBSA burned.

52.

A patient presents to the emergency department with partial-thickness burns to the face, neck, arms, and chest after attempting to put out a kitchen fire. Which of the following nursing actions should not be implemented for this patient?

Place a cooling blanket on the patient

Administer supplemental oxygen as indicated

Elevate extremities if no fractures are present

Assess for airway patency

Correct answer: Place a cooling blanket on the patient

The primary goal for a burn injury is to identify any immediately life-threatening problems; ensure a stable, controlled, and patent airway; and initiate intravenous (IV) fluid resuscitation to prevent hypovolemic shock and preserve vital organ functioning. Oxygen is necessary to perfuse vital tissue and organs and should be administered as ordered. The extremities are elevated to assist in preventing shock and decrease the amount of fluid moving to the extremities (especially in the burn-injured upper extremities).

Virtually all patients with loss of the epidermal barrier will become hypothermic and need to be kept warm. Thus, a cooling blanket is an inappropriate intervention.

53.

Which of the following statements is false regarding crystalloids for fluid resuscitation in burn shock patients?

They increase the intravascular osmotic pressure to reduce fluid loss through the capillaries.

They are effective most of the time.

They are significantly less expensive than colloids and much easier to store.

There is little risk of transmitting infectious organisms compared to human-derived products.

Correct answer: They increase the intravascular osmotic pressure to reduce fluid loss through the capillaries.

Colloids, not crystalloids, increase the intravascular osmotic pressure to reduce fluid loss through the capillaries. Crystalloids have been favored for many years because they are effective most of the time, there is little risk for infectious transmission, and they are less expensive and much easier to store than colloids.

54.

You are admitting a 45-year-old male patient with an erythematous, painful thermal burn that involves the entire surface of the posterior left leg with good capillary refill. What total burn surface area (TBSA) is involved?

- **9%**
- 18%
- 4.5%
- 16%

Correct answer: 9%

When caring for a patient with a burn wound, nurses should estimate/calculate the affected TBSA of the burn injury. The Rule of Nines can be used to get an estimate. The anterior and posterior surface of an adult leg is approximately 9%; if both the front and back of the leg are affected, that accounts for 18%. The anterior or posterior surface of an arm is 4.5% each.

An adult patient with a burn over the entire surface of the posterior leg would have an estimated TBSA of 9% affected by the burn injury.

55.

A trauma nurse has several immediate priorities during the acute phase of trauma resuscitation, including airway and adequate ventilation, control of hemorrhage, and which of the following?

Circulation, perfusion, and initiation of fluid administration

Circulation, perfusion, and obtaining a type and cross to begin colloid administration

Circulation, perfusion, and bilateral intravenous (IV) access for pain control

Achieving hemodynamic stability and minimizing hypothermia

Correct answer: Circulation, perfusion, and initiation of fluid administration

A resuscitation nurse plays a vital role in the rapid assessment and stabilization of patients upon their arrival. The primary assessment must be completed quickly and efficiently and is comprised of priority-based trauma protocols that provide the framework for detecting and treating life-threatening injuries.

The initial priorities in trauma resuscitation are always the ABCs:

- *A: Airway and alertness*
- *B: Breathing and ventilation*
- *C: Circulation and control of hemorrhage*

56.

You are the triage burn nurse on duty. You receive a phone call from a 30-year-old female who has sustained a hot oil splash on her abdomen while cooking. The affected area has redness, blisters, and intense pain. She reports no known drug allergies.

What should you instruct the patient to do as an initial step in managing her injuries?

Cover the burn loosely with a clean, non-stick sterile dressing

Apply vinegar to the burn to prevent infection

Use adhesive tape to seal the burn blisters

Scrub the burn gently to remove any oil residue

Correct answer: Cover the burn loosely with a clean, non-stick sterile dressing

Prehospital care of wounds is basic and fairly simple; it requires only protection from the environment with the application of a clean dressing or sheet to cover the involved part. Covering the burn with a clean, non-stick sterile dressing helps protect the area from infection and reduces pain. The patient should be advised to wrap herself in a blanket to minimize heat loss and get to the closest emergency department for further assessment and management of her burn injury.

Applying vinegar, sealing blisters with adhesive tape, and scrubbing the burn are not recommended.

57.

You are collecting a medical history of a male patient who experienced 50% TBSA partial-thickness burns. Which of the following conditions should alert you to modify the patient's burn fluid resuscitation plan?

Coronary artery disease (CAD)

Seasonal asthma

Renal calculi in the past year

Hepatitis B virus infection 5 years ago

Correct answer: Coronary artery disease (CAD)

Patients with significant comorbidities (e.g., heart failure, cirrhosis, preexisting renal insufficiency, morbid obesity) often do not respond in the usual way to fluid resuscitation and may benefit from closer monitoring. In this scenario, the patient likely has a diminished cardiac output secondary to his medical history of CAD and would be at greater risk for the development of congestive heart failure and pulmonary edema during fluid resuscitation. Because of this, the patient's plan of care should be modified.

The other choices do not warrant a modification of the fluid resuscitation plan.

58.

You are triaging a patient in the emergency department (ED) who sustained a chemical burn after spilling a can of paint on their legs. The label on the can shows lye as the primary ingredient. Which of the following statements is accurate regarding this type of burn?

This type of burn tends to be deeper

This is an acidic burn

This type of burn will be easier to neutralize

This patient is at risk for compartment syndrome

Correct answer: This type of burn tends to be deeper

Alkalis (lyes) are highly corrosive and tend to penetrate more deeply than chemical burns caused by an acidic agent. Wounds caused by alkalis appear superficial initially but often become full-thickness in 2-3 days. Neutralizing an alkali burn is more difficult than an acidic burn.

Compartment syndrome is more characteristic of electrical burns.

59.

You would expect to see all the following laboratory trends in a patient who sustained a severe thermal burn injury approximately 24 hours ago, except:

Increased testosterone levels

Increased antidiuretic hormone (ADH) levels

Increased cortisol levels

Increased catecholamines

Correct answer: Increased testosterone levels

The stress associated with thermal injury, as well as the subsequent fluid shifts, induces endocrine responses similar to other critical illnesses. Testosterone, dehydroepiandrosterone (DHEA), and triiodothyronine (T3) levels decline, while ADH, cortisol, catecholamines, and the renin-angiotensin system (RAS) increase.

Replacement of testosterone with analogs has been shown to reduce the length of hospital stay, reduce lean body mass loss, improve body composition, and increase hepatic protein synthesis.

60.

You are caring for a patient with a high-voltage electrical burn and suspect the patient may be developing compartment syndrome. What is the most reliable indicator of this syndrome?

Severe pain with passive motion

Pulselessness in the affected extremity

Delayed capillary refill time and swelling

Decreased distal sensation, paresthesia, or burning

Correct answer: Severe pain with passive motion

High-voltage injuries place the patient at high risk of compartment syndrome, as damaged muscle and swelling in the affected extremity's fascia may cause increased pressure, compromising blood flow. This syndrome can affect nerves, circulation, and muscles. Patients most often experience severe pain with passive motion that tends to be out of proportion to the injury and is unrelieved by pain medications. The pain increases with passive stretching of the muscles. For example, flexion of the ankle and foot or the toes causes increased pain in the lower leg.

Capillary refill time may be delayed, and swelling generally does happen rapidly in compartment syndrome. The compression leads to muscle and nerve damage and must be treated quickly. A surgical consult should be placed immediately, and any restrictive dressings, casts, and coverings should be removed. Pulses are usually present; pulselessness, paresthesia, and paralysis are late signs. These findings are not as reliable, however, as severe pain with passive motion.

61.

In the resuscitative phase of burn injury management, what is the most reliable and most sensitive noninvasive assessment parameter for cardiac output and tissue perfusion?

Urinary output

Stable vital signs

Palpable peripheral pulses

Intact level of consciousness

Correct answer: Urinary output

Optimizing resuscitation and ensuring volume administration is sufficient to achieve organ perfusion at the lowest physiologic cost will require hourly monitoring of urine output, hemodynamics, and clinical signs of adequate perfusion. The titration of fluids is based on these parameters. The primary index of adequacy of resuscitation is most often the urinary output (UO), as it is a surrogate metric for glomerular filtration rate (GFR), renal blood flow, and cardiac output (CO).

Successful fluid resuscitation is also measured by the other choices, but UO remains the most reliable and most sensitive indicator.

62.

You are providing care to a severely burned adult patient in the resuscitative phase. Which of the following electrolyte imbalances would be least likely to cause a cardiac rhythm disturbance?

Hyponatremia

Hyperkalemia

Hypercalcemia

Hypophosphatemia

Correct answer: Hyponatremia

Major electrolyte disturbances can alter the heart's electrical conduction activity and, in some cases, may become life-threatening. Electrolytes are ions that conduct electrical current and are essential for proper cell function. While most electrolyte disturbances have the potential to alter cardiovascular rhythm, hyponatremia and hypernatremia are not typically a direct cause of rhythm changes.

Hyponatremia is common within the first 24 hours of a severe burn injury and is associated with cerebral edema and secondary seizures. However, this can be avoided by minimizing the use of hypotonic fluid during resuscitation.

63.

What is the most frequently used crystalloid solution for burn shock resuscitation?

Lactated Ringer's (LR)

5% albumin in normal saline (NS)

Normal saline (NS)

5% dextrose in water

Correct answer: Lactated Ringer's (LR)

Crystalloids are the mainstay of burn shock resuscitation, and lactated Ringer's (LR) solution is the common fluid used in the initial resuscitation of burn injury. For resuscitation purposes, the administration of LR compared to normal saline (NS) maintains a higher plasma pH and less pulmonary edema. It also prevents the hyperchloremic acidosis that can be seen with large saline infusions and treats hypovolemia effectively. For pediatric patients under 10 kg, dextrose is often added to LR solution during burn shock resuscitation due to decreased glycogen storage in small children.

Five percent albumin in NS is the most commonly used colloid (not crystalloid) for burn resuscitation today.

64.

What is the total resuscitation volume for a 10 kg infant (body surface area 0.5 m^2) with 50% total body surface area (TBSA) burns for the first 8 hours?

1,500 mL

2,000 mL

1,000 mL

3,000 mL

Correct answer: 1,500 mL

Pediatric burn resuscitation is as follows:

- *Daily basal fluid requirements + 4 mL/kg/% TBSA*
- *<30 kg = 2,000 x body surface area*
- *>30 kg = 1,500 x body surface area*

So, for a 10 kg infant, take 2,000 x 0.5 = 1,000 mL/day + (4 x 10 x 50). 1,000 mL + 2,000 mL = 3,000 mL in 24 hours. Give half in the first 8 hours = ***1,500 mL/8 hr*** *= 187.5 mL/hr.*

65.

A 29-year-old male spilled a can of paint stripper while doing home renovations and cleaned it without using gloves. He reports washing his hands shortly after. Approximately 10 minutes after the incident, he experienced painful, blanching erythematous patches on his palms, the back of his hands, and his left cheek. The patient's left eye is painful and sensitive to light. The label on the can shows lye as the primary ingredient.

All the following are concerns for this patient, except:

Compartment syndrome

Evolution to a greater depth injury over time

Loss of range of motion in the hand

Conjunctival burns

Correct answer: Compartment syndrome

Chemical burns may develop a greater depth of injury than what appears on initial assessment. Wounds caused by alkalis (lyes) initially appear superficial but may often become full thickness in 2-3 days. Alkalis are highly corrosive in nature and penetrate deeply. Splash incidents may cause burns to the eyes. Hand burns carry a risk of stiffness unless they are properly splinted and managed with physical therapy exercises.

Compartment syndrome is more characteristic of electrical burns.

66.

A 25-year-old female patient is admitted to the emergency department after sustaining a chemical burn on her face and neck due to a workplace accident involving an acidic solution. The affected skin is discolored, and she is in severe pain.

What is the recommended immediate action for managing this patient's chemical burn?

Irrigate the burn area with gently flowing cool water

Apply a neutralizing agent on the burn area

Rub the burn area with a dry cloth to remove any residue

Open any blisters that may form on the burn area and cover with sterile nonadhesive dressing

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Correct answer: Irrigate the burn area with gently flowing cool water

Initial care for most chemical burns consists of the immediate removal of clothing, including jewelry and shoes, and dusting off any powders. Emergency personnel should protect themselves with appropriate personal protective equipment (PPE). Immediate copious irrigation (with tap water) will reduce the extent and depth of injury. Irrigation should be a large-volume shower or decontamination station and drained via an appropriate drain. Irrigating the burn area with cool tap water helps remove the chemical(s) and reduce tissue damage.

Neutralizing agents can react and worsen the burn; they can cause exothermic reactions, producing a thermal component along with a chemical injury. For these reasons, the use of neutralizing agents is generally contraindicated. Rubbing the burn or opening the blisters is not recommended.

67.

What is the recommended urinary output (UO) in adult burn resuscitation management?

30-50 mL/hr

>50 mL/hr

0.5 to 1.0 mL/kg/hr

1.0 to 2.0 mL/kg/hr

Correct answer: 30-50 mL/hr

The primary index of adequacy of resuscitation is most often the urinary output. The amount of fluid administered depends on how much intravenous (IV) fluid per hour is required to maintain a urinary output of 30 to 50 mL/hr. UO is usually recorded hourly.

For children weighing less than 30 kg, the recommended UO is 0.5 to 1.0 mL/kg/hr. For infants, the recommended UO is 1.0 to 2.0 mL/kg/hr.

68.

What surgical procedure is used to relieve compartment syndrome and resulting nerve damage secondary to tissue edema?

Fasciotomy

Escharotomy

Grafting

Incision and drainage

Correct answer: Fasciotomy

Compartments are defined as closed spaces containing nerves, muscles, and vascular structures that are enclosed by fascia. Compartment syndrome may result when either the internal contents or external sources cause an increase in compartment pressure.

Internal etiologies of increased compartment pressures include conditions that cause blood accumulation, tissue edema, or fluid infiltration within the closed space. External causes, such as constricting dressings, decrease the size of the compartment. When compartment pressures exceed 30 mm Hg, surgical decompression by open fasciotomy becomes necessary to prevent ischemic muscle injury.

A fasciotomy is a surgical incision into a compartment to relieve pressure on neurovascular structures and restore effective perfusion.

69.

You are caring for a patient who sustained a high-voltage burn injury, and you suspect compartment syndrome. The patient's pulse is still present in the affected extremity. Which of the following is accurate?

Irreversible ischemia can occur while the pulse is still palpable

Ischemia begins to develop once the pulse is absent

Pulse quality, not pulse presence, is used to determine whether compartment syndrome is developing

Pulse does not need to be assessed in a patient with suspected compartment syndrome

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Correct answer: Irreversible ischemia can occur while the pulse is still palpable

Compartment syndrome may result in a decreased or absent pulse, but irreversible ischemia can occur from compartment syndrome while the pulse is still palpable. Intracompartmental pressures above 30 to 40 mm Hg can cause muscle ischemia, and pressures over 55 to 65 mm Hg may result in irreversible muscle death. Systolic blood pressure is often significantly higher than this, causing blood to continue to pass through the compartment even when ischemia is occurring due to pressures inhibiting capillary blood flow.

Ischemia can begin to develop prior to loss of pulse in the extremity. Both pulse presence and pulse quality can help indicate the presence of compartment syndrome; however, pulse should not be the sole assessment method. Pulse should always be assessed in a patient with suspected compartment syndrome.

70.

Which of the following burn patients should not be transferred and treated at a burn center?

Burns of >10% in TBSA patients in patients under 12 years old

Burns of >10% in patients over 50 years old

Any second- or third-degree burns involving the hands or feet

Any second- or third-degree burns involving the perineum

Correct answer: Burns of >10% in TBSA patients in patients under 12 years old

Second- and third-degree burns that are greater than 10% TBSA in patients under 10 or over 50 years of age should qualify for transfer and admission to a burn center. These types of burns carry particular morbidity and mortality. In addition, burns involving the hands, feet, perineum, face, or neck are technically demanding because of the high stakes involved and the challenges in optimizing long-term outcomes.

71.

A patient presents to the emergency department with partial-thickness burns to the face, neck, arms, and chest after attempting to put out a bonfire. Which of the following interventions should not be implemented for this patient?

Administer intramuscular pain mediation as ordered

Initiate intravenous (IV) fluid resuscitation

Assess respiratory status

Keep the patient warm

Correct answer: Administer intramuscular pain medication as ordered

Intramuscular (IM) or subcutaneous routes for medication delivery should never be used because fluid resuscitation could result in unpredictable patterns of uptake. NPO (nothing by mouth) status should be implemented because of the altered gastrointestinal function from a burn injury.

The other actions should be a part of the initial burn care process.

72.

What is the preferred method of airway control for a burn victim with a compromised airway?

Endotracheal tube

Standard tracheostomy

Nasopharyngeal airway

Oropharyngeal airway

Correct answer: Endotracheal tube

Endotracheal intubation and mechanical ventilation have salvaged many thousands of burn patients since being widely employed in the late 1950s. It is the preferred method of airway control, providing a stable airway, protecting against aspiration, and permitting mechanical ventilation to be utilized. Endotracheal tubes also decrease gastric distention associated with bag-mask ventilation.

Endotracheal tubes should be used with caution in laryngotracheal injuries (i.e., of the glottis, subglottis, and upper trachea).

73.

Carbon monoxide (CO) intoxication is managed with effective ventilation with 100% oxygen for how long?

6 hours

4 hours

2 hours

8 hours

Correct answer: 6 hours

The major treatment approach for a burn patient with evidence of smoke inhalation injury secondary to carbon monoxide (CO) intoxication is the administration of 100% oxygen and, in severe cases, hyperbaric treatment to increase the partial pressure of oxygen in the blood.

The standard of care is 6 hours of 100% normobaric oxygen. If there is more severe exposure to CO, as indicated by a carboxyhemoglobin level greater than 30% or neurologic changes, hyperbaric oxygen is recommended to reduce the incidence of long-term neurological complications.

74.

For burn-injured patients, colloid administration for fluid resuscitation should be initiated approximately how many hours after the initial injury?

12 hours

4 hours

8 hours

24 hours

Correct answer: 12 hours

The use of colloids in early burn resuscitation remains controversial. Initiating colloids in the first 12 hours has been associated with less favorable outcomes; therefore, albumin administration is traditionally not recommended until at least 12 hours after the burn.

75.

What is the best indicator of adequate fluid resuscitation for a burn-injured patient?

Urine output

Stable blood pressure

Absence of fevers

Arterial blood gases in a normal range

Correct answer: Urine output

The goal of fluid resuscitation for a burn patient is to maintain tissue perfusion and organ function. Over-resuscitation can lead to significant edema, which can compromise blood flow to burned tissue, while under-resuscitation can cause shock and organ damage.

The single best indicator of proper fluid replacement is urine output, which should be closely monitored and managed. The recommended fluid of choice is lactated Ringer solution.

76.

The Parkland formula for burn resuscitation stipulates which of the following?

Lactated Ringer's 4 mL/kg of body weight/percent of TBSA for second- and third-degree burns; half to be given in the first eight hours after injury, and the remaining half to be distributed over the next 16 hours

Lactated Ringer's 4 mL/kg of body weight/percent of TBSA for second- and third-degree burns; half to be given in the first eight hours after arrival at the hospital and the remaining half to be distributed over the next 16 hours

Normal saline 4 mL/kg of body weight/percent of TBSA for second- and third-degree burns; half to be given in the first eight hours after arrival at the hospital and the remaining half to be distributed over the next 16 hours

Normal saline 4 mL/kg of body weight/percent of TBSA for second- and third-degree burns; half to be given in the first eight hours after injury, and the remaining half to be distributed over the next 16 hours

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Correct answer: Lactated Ringer's 4 mL/kg of body weight/percent of TBSA for second- and third-degree burns; half to be given in the first eight hours after injury, and the remaining half to be distributed over the next 16 hours

Isotonic crystalloid is still the most commonly used fluid for resuscitation in US burn centers. The Parkland Formula for volume resuscitation uses isotonic crystalloid solutions and estimates the fluid requirements in the first 24 hours to be 4 mL/kg per TBSA burned.

"The first eight hours" refers to the first 8 hours after injury. If this is misinterpreted by the healthcare team to mean the first eight hours after presentation to the hospital, volume resuscitation could be seriously delayed.

77.

Which of the following best describes when colloids should be used for burn shock?

Colloids should be used if a patient's initial response to crystalloids is insufficient

Colloids should be used for sepsis

Colloids should be used for burns during the first 24 hours post-injury

Colloids are predominantly used for burn resuscitation in the United States

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Correct answer: Colloids should be used if a patient's initial response to crystalloids is insufficient

Colloids are large molecule solutions that are used when a patient's initial response to crystalloids is insufficient. Colloids stay in the vascular space better than crystalloids and may be used in hypovolemic shock or neurogenic shock. Colloids should not be used in the first 24 hours when capillary permeability is increased, such as with sepsis, anaphylaxis, or burns.

Crystalloids are the mainstay of burn shock resuscitation in US burn centers, and lactated Ringer's (LR) is the most frequently used crystalloid solution.

78.

You are caring for a burn victim with a tracheostomy and need to suction the patient. Prior to suctioning, you should perform which nursing intervention?

Hyperoxygenate the patient

Assist the patient into a side-lying position

Disconnect pulse oximetry

Have the patient cough

Correct answer: Hyperoxygenate the patient

Before a patient with a tracheostomy receives suctioning, they will need to be hyperoxygenated because, during suctioning, the patient's oxygen supply will be decreased.

The other choices are incorrect.

79.

A patient presents to the emergency department with a painful and blistering thermal burn involving the big, index, and middle toes of the left foot. What is the most appropriate plan of care for this patient?

Refer to a burn center

Apply topical anesthetic agent to the area and open blisters

Apply silver sulfadiazine cream to the area and cover with a sterile dressing

Wrap loosely with a nonadherent dressing and administer analgesics for pain management

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Correct answer: Refer to a burn center

Criteria for transferring a burn patient to a burn center include any burn that involves the face, hands, feet, genitalia, perineum, and major joints. Burns to the toes require immediate referral to a burn specialty center to prevent loss of function and provide appropriate management.

The other choices may be part of the plan of care once evaluation by a burn specialist has been completed.

80.

What is one of the last signs of true compartment syndrome?

Loss of pulses

Pain

Pallor

Delayed capillary refill

Correct answer: Loss of pulses

Compartment syndrome occurs when pressure builds within the muscles to dangerous levels. Special consideration should be given to burns that are completely circumferential around a part of the body, such as a limb or the trunk. These types of wounds can cause increased pressure due to the tissue beneath the wound becoming edematous, resulting in compartment syndrome and ischemia.

The most reliable indicator of this condition is severe pain with passive motion. The pain tends to be out of proportion with the injury and unrelieved by pain medications. Capillary refill time may be delayed. The patient may experience decreased distal sensations, paresthesia, or a "burning" sensation. Pulses are usually present; pulselessness is a late sign of compartment syndrome, along with paresthesia and paralysis.

81.

An electrical burn injury patient has an irregular, accelerating, and decelerating rhythm with a heart rate of 70 beats per minute on their initial electrocardiogram (ECG). What is your priority intervention?

Continue to monitor

Administer supplemental oxygen

Notify the attending physician

Administer a painful stimulus

Correct answer: Continue to monitor

Most patients with electrical injuries (including lightning strikes) have abnormalities on ECG that include sinus tachycardia and nonspecific changes in the ST-segment and T-wave. Death from electrical injury most commonly results from current-induced cardiac arrest. However, if an initial ECG shows no abnormalities, the delayed development of cardiac problems is unlikely, irrespective of whether the patient sustained high- or low-voltage injuries.

In this scenario, the patient's heart rate is accelerating and decelerating with inspiration and expiration, which is sinus arrhythmia. This is a normal ECG finding (a variation of NSR). No treatment is indicated for this finding, and your priority intervention is to continue to monitor this patient.

82.

A 26-year-old female is rescued from her bed by firefighters during a house fire. She is unconscious and was intubated in the field. An intravenous (IV) line is started, and IV fluids are initiated. At the burn center, she has 45% TBSA burns on her torso and arms.

What complication is the greatest risk at this time?

Pneumonia

Wound sepsis

Hypovolemic shock

Unrecognized fractures

Correct answer: Pneumonia

Respiratory failure is a common occurrence after serious burns. The complication with the highest incidence in major burn patients is pneumonia. Pneumonia or tracheobronchitis occurs in over half of patients with inhalation injuries. Management involves providing support for gas exchange while identifying and correcting the underlying pathology.

83.

How is the size of a burn injury described, and what methods are available to describe the extent of the burn injury?

Percent total body surface area burned calculated using the Rule of Nines or with the Lund and Browder chart

Percent total body surface area burned calculated using the Rule of Tens or with the Lund and Browder chart

Actual total body surface area burned calculated using the Rule of Nines or with the Lund and Browder chart

Actual total body surface area burned calculated using the Rule of Tens or with the Lund and Browder chart

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Correct answer: Percent total body surface area burned calculated using the Rule of Nines or with the Lund and Browder chart

The size of a burn injury is described using the percentage of total body surface area (TBSA) and may be estimated by using the Wallace "Rule of Nines" or with the Lund and Browder chart.

The Rule of Nines is a rough estimate that assumes adult body proportions and was intended as fast orientation at the scene of an accident/injury. Its simplicity, however, has contributed to its wide use even in burn centers. The Lund and Browder chart assigns various age groups to corresponding body proportions. It is age-specific and accounts for the changing body proportions with age. It uses adapted planimetry for the calculation procedure and is regarded as the most accurate and preferred procedure by most clinicians.

84.

Nasal endotracheal tubes are often avoided in the burn intensive care unit (BICU) due to concern about which condition?

Sinusitis

Epistaxis

Damage to the nasal cavity

Aspiration

Correct answer: Sinusitis

There are concerns about the development of sinusitis when using nasal endotracheal tubes. However, a nasal endotracheal tube is much more secure than an oral tube and better tolerated by patients, and patients cannot occlude the nasal tube by biting it. A thorough risk vs. benefit analysis should always be performed in any scenario in which a patient needs an artificial airway.

Complications of nasotracheal intubation include epistaxis, damage to the nasal cavity, and aspiration.

85.

You are caring for a patient who was struck by lightning approximately 48 hours ago. During your morning assessment, you note dark tea-colored urine draining from the patient's Foley catheter. What is the most appropriate intervention given this new assessment finding?

Aggressive fluid replacement and diuresis

Continuous renal replacement therapy

Administration of packed red blood cellls and fresh frozen plasma

Dopamine infusion and furosemide administration

Correct answer: Aggressive fluid replacement and diuresis

Rhabdomyolysis is the rapid dissolution of skeletal muscle triggered by skeletal muscle injury and ischemia that is followed by reperfusion. It results in the release of inflammatory mediators and further injury to the myocytes. Lightning strikes can cause muscle injury. Destroyed muscle cells release myoglobin, resulting in myoglobinemia, and can lead to rhabdomyolysis. Clinical signs of high levels of myoglobin in urine are evident when myoglobin levels reach 100 mg/dL when urine appears darker (rust-colored, dark-tea-colored, or cranberry-colored), described as myoglobinuria.

Treatment goals include prevention or attenuation of acute kidney injury (AKI) through aggressive intravenous (IV) fluid administration, diuresis (via mannitol), and alkalinization of urine (with bicarbonate). IV fluids maintain circulating blood volume and renal perfusion. The objective is to flush the myoglobin from the kidneys until a (clear) urine output of 200 to 300 mL/hr is achieved.

86.

What is the definitive treatment for abdominal compartment syndrome (ACS)?

Decompressive laparotomy

Percutaneous drainage of the abdominal cavity

Chest and abdominal escharotomies

Nasogastric and Foley catheter insertion to ensure organs are not distended

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Correct answer: Decompressive laparotomy

Abdominal compartment syndrome is a significant risk for severely burn-injured patients associated with massive volume resuscitation, inducing generalized edema in a relatively limited peritoneal compartment. An early sign of this life-threatening complication is oliguria, which is often addressed by more intravenous fluids and worsens the developing ACS. The associated physical finding is abdominal distention.

Treatments are aimed at reducing intraabdominal pressures through drainage (via chest and abdominal escharotomy, percutaneous drainage of the abdominal cavity, and NG and Foley catheter placement), sedation, and paralysis. Laparotomy and surgical decompression are the definitive management of ACS to support pulmonary function.

87.

What is the primary goal in the initial management of a burn-injured patient?

Provide adequate fluid resuscitation

Maintain normal tissue oxygenation

Prevent hypothermia

Manage pain

Correct answer: Provide adequate fluid resuscitation

Providing adequate fluid resuscitation to restore circulating volume and to minimize conversion of the zone of stasis to necrosis or full-thickness tissue injury is the main goal in the initial management of a burn-injured victim.

Other initial goals will focus on managing pain, maintaining normal tissue oxygenation, and maintaining normothermia.

88.

In the Parkland Burn Resuscitation Formula, half of the fluid (Ringer's lactate) is given during which timeframe?

First 8 hours

First 4 hours

First 12 hours

First 6 hours

Correct answer: First 8 hours

The Parkland formula has become the standard of care in the resuscitation of severely burned patients. It recommends crystalloids during the first 24 hours of management. In the original Parkland formula, 4 mL per kilogram (kg) of body weight per percent TBSA (total body surface area of burned skin) of intravenous fluid is administered over the first 24 hours following injury. Half of this volume is administered in the first 8 hours and the other half is given in the following 16 hours. In the next 24-hour period, dextrose- and potassium-containing fluid is administered to maintain vascular volume, and colloid-containing fluid is administered at 20-60% of the calculated plasma volume.

In practice, the Parkland formula is used as a starting point for resuscitation. Guidelines for the management of fluid titration have been developed to reduce the rate of fluid administration hourly based on urine output.

89.

Which of the following is the most urgent type of ocular emergency?

Chemical burns

Thermal burns

Radiation burns

Steam burns

Correct answer: Chemical burns

Chemical burns are the most urgent type of ocular emergency of the options available, as some chemical burns can create ongoing damage until addressed.

Steam burns are a type of thermal burn. Thermal burns and radiation burns may damage the globe, but these types of injuries do not generally lead to ongoing damage that must be neutralized after the event.

90.

A 62-year-old male was rescued from a burning building and brought into the emergency department via ambulance. He is unconscious, and his skin color is bright red. What should you do first?

Apply 100% oxygen via a non-rebreather mask

Insert two large-bore intravenous lines and initiate fluid resuscitation

Assess for signs of inhalation injury

Prepare for intubation and mechanical ventilation

Correct answer: Apply 100% oxygen via a non-rebreather mask

The patient is likely experiencing carbon monoxide (CO) poisoning, which is managed by immediately administering 100% FIO_2 via a face mask. The other interventions can be initiated once the patient's airway is appropriately managed.

91.

You are caring for a patient who sustained deep circumferential chest burns and is receiving fluid resuscitation. You begin to suspect abdominal compartment syndrome (ACS).

All the following are cardinal signs of this life-threatening complication, except:

Prolonged capillary refill and absent distal pulses

Hemodynamic instability

Oliguria

Elevated peak inspiratory pressures

Correct answer: Prolonged capillary refill and absent distal pulses

Abdominal compartment syndrome (ACS) is a serious problem associated with the development of burn edema; it manifests as respiratory compromise. The increased diffuse capillary leak seen in patients with large burns produces increased fluid translocation into the abdominal compartment. Intra-abdominal pressures and peak airway pressures increase, causing minimal urine output (due to compression of renal veins), difficulties with ventilating, and hemodynamic instability.

Prolonged capillary refill time and absent distal pulses indicate the need for an escharotomy or fasciotomy.

92.

The initial evaluation and resuscitation phase of burn care takes place within the first 72 hours post-injury. Which of the following objectives is not a priority?

Replace temporary wound membranes with permanent coverage

Clearly identify all injuries

Perform an accurate individualized fluid resuscitation

Ensure effective decompression of extremities and torso

Correct answer: Replace temporary wound membranes with permanent coverage

Inpatient care of larger burns has four general phases. The duration and intensity of each phase will vary with wound extent and complexity. Throughout the first 72 hours, short-term objectives include all the options below except replacing temporary wound membranes with permanent coverage. This objective is generally not a priority until the definitive wound closure phase, which happens sometime between weeks one and six, respectively.

93.

A cornerstone in the treatment of burn injury is fluid treatment. Usually, intravenous fluids are provided to burn injuries of what size?

Over 15% TBSA

Over 20% TBSA

Over 25% TBSA

Over 10% TBSA

Correct answer: Over 15% TBSA

Generally, IV fluid is administered to injuries larger than 15% total burn surface (TBSA). IV lines are most commonly applied to the extremities of noninjured tissue, but in cases of massive burns, burned areas may be used.

The initiation of fluids may be started early at the scene of the accident but should not significantly delay transportation. If transportation is planned for more than 1 hour, starting IV fluid is often recommended.

94.

You are caring for a patient with severe burns who has crystalloid fluid replacement ordered. Based on the Parkland formula, the initial volume of fluid to be given in the first 24 hours is 28,000 mL. The initial rate of administration is 1,750 mL/hr. After the first 8 hours, at what rate should the nurse infuse the intravenous (IV) fluids?

875 mL/hr

110 mL/hr

583 mL/hr

1,167 mL/hr

Correct answer: 875 mL/hr

Half of the fluid replacement using the Parkland formula is administered in the first 8 hours, and the other half is given over the next 16 hours.

In this scenario, 28,000/2 = 14,000 mL. Take 14,000 mL/8 = 1,750 mL/hr for the first 8 hours. The other half is then given over the next 16 hours, so 14,000/16 = 875 mL/hr.

95.

An adult patient weighs 80 kg and has a burn that covers 25% of their body (TBSA). What is the total fluid that is needed in the first 24 hours if the maximal amount of 4 mL is used per the Parkland formula?

8,000 mL

800 mL

1,920 mL

920 mL

Correct answer: 8,000 mL

The Parkland formula is used to calculate the amount of fluid to be given in the first 24 hours following an acute burn injury. To solve this question, you will need to use the formula for burn resuscitation in an adult.

4 mL x % of burn x body weight (kg) = quantity over 24 hours

4 mL x 25 x 80 = 8,000 mL

You will not convert the % TBSA (25%) to a decimal (0.25) but will multiply it as a whole number (25).

96.

How does the Lund and Browder chart help with estimating the extent of burns?

Allowing the burn to be estimated by age, development, and percent of body part

Dividing the body into 7 areas of 9% each with a final 1% for the genitalia

Dividing the body into 10 equal areas of 10% each

Dividing the body into areas that are burned and areas that might be burned

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Correct answer: Allowing the burn to be estimated by age, development, and percent of body part

The Lund and Browder chart assigns various age groups to corresponding body proportions. It is age-specific and accounts for the changing body proportions with age. It divides the body into multiple areas, taking into consideration changes in the contribution of the head and legs from infancy to adulthood. It uses adapted planimetry for the calculation procedure and is regarded as the most accurate and preferred procedure by most clinicians.

The Rule of Nines provides a rapid, gross estimate of the extent of the burn. With this method, the adult body is divided into 7 areas that represent 9% (or multiples of 9%) of the body surface area, with the remaining area (i.e., genitalia) representing 1% of TBSA.

97.

Which of the following patients would not qualify for admission to a burn center?

A 15-year-old female with 8% TBSA partial-thickness burns to her chest from a clothing fire

A 30-year-old male construction worker with 2% roofing tar burns to the dorsum of his left foot

A 2-year-old female with 5% TBSA scald burns in a glove pattern on her left hand and forearm

A 40-year-old male with a <1% TBSA burn on his left index fingertip and a 2% TBSA burn on his right buttock after touching an exposed electrical wire

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Correct answer: A 15-year-old female with 8% TBSA partial-thickness burns to her chest from a clothing fire

Criteria for burn center referral and transfer include any patient with partial-thickness burns to greater than 10% of total body surface area (TBSA), burns over high-risk areas, situations of suspected abuse, and chemical or electrical burns of any degree or size.

Otherwise, thermal burns of less than 10% TBSA in noncritical areas (not classified as full-thickness burns) can generally be managed in community hospitals or on an outpatient basis.

98.

A patient presents after splashing their arm with a concentrated alkali fluid at work. Which of the following is true for this patient?

The substance is still causing tissue damage if it has not been flushed or irrigated

While an acid solution would be harmful, an alkali solution is unlikely to cause chemical burns

The solution should be neutralized if still present, not irrigated

The depth of tissue damage caused by the chemical burn should be assessed early in your nursing assessment

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Correct answer: The substance is still causing tissue damage if it has not been flushed or irrigated

An alkali chemical burn will continue to cause damage as long as the chemical remains in contact with body tissues. Flushing or irrigating the area is the best way to remove and dilute the chemical simultaneously. The solution should not be neutralized. The chemical reaction neutralizing the alkali requires adding an acid to the patient's skin, and the resulting reaction could cause harmful thermal changes. Alkali solutions are generally more damaging than acidic chemicals.

The depth of damage is not likely to be known until affected tissue sloughs off, a process that often takes days.

99.

A patient arrives at the emergency department with severe electrical burns from exposure to a high-voltage current. Which of the following interventions should take priority?

Perform an electrocardiogram (ECG)

Check serum electrolytes

Assess temperature

Assess for pain at contact points

Correct answer: Perform an electrocardiogram (ECG)

Electrical injuries can result in an array of cardiac arrhythmias and ischemia. The most common cause of death due to electrical injury is immediate cardiac arrest. An ECG should be performed as soon as possible to rule out and treat any immediate dysrhythmias. This intervention is a well-established component of the early evaluation of patients after electrical injury.

Assessing temperature and pain and drawing labs are also important aspects of care, but the priority in this scenario is placing the patient on a cardiac monitor and assessing for cardiac abnormalities, which can be fatal.