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Why should **reptiles** be kept at the **upper limit of their normal temperature** range during induction, surgery and anesthetic recovery?

<input type="checkbox"/> Prevents vomiting	HIDE
<input type="checkbox"/> Lower temperatures associated with paradoxical tachycardia	HIDE
<input type="checkbox"/> Delays righting reflex until animal is fully awake	HIDE
<input type="checkbox"/> Prevents switching to anaerobic metabolism	HIDE
<input type="checkbox"/> Optimizes anesthetic metabolism and recovery	HIDE

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1


Why should we monitor temperature during induction?

Prevent hypothermia

Lower temperature

Delays recovery

Prevent hypothermia



Correct: **Optimizes anesthetic metabolism and recovery**

Reptiles have a preferred optimal temperature range (POTR) for optimal uptake, action, transformation and excretion of premedication sedatives and maintenance anesthetics.

Lower temperatures slow a reptile's metabolism which, in turn slows the elimination of drugs out of the body and delays recovery from anesthesia or sedation.

Refs: Mader, Reptile Medicine & Surgery, 2nd ed., pp. 442-45 and the Merck Veterinary Manual online edition.

Optimizes anesthetic metabolism and recovery HIDE

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Which choice is often used in combination with ketamine and thiopental to induce anesthesia in horses

Naloxone	HIDE
Guaifenesin	HIDE
Halothane	HIDE
Phenobarbital	HIDE

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1

Which ch
anesthes

- Naloxon
- Guaifene
- Halotha
- Phenoba

Correct:

Guaifenesin is an anti-tussive (anti-cough) and decongestant med that also works as a muscle relaxant. Guaifenesin is often used to support excitement-free anesthesia induction and recovery in horses.

Naloxone is a reversal agent against opiate drugs (In horses, Butorphanol (Torbugesic®) is a commonly used opiate)

Halothane gas would not work to mask a horse down into anesthesia because you would expect problems restraining the animal in the excitement phase of induction.

Phenobarbital is a long-acting barbiturate used to control epilepsy/seizures, not induce.

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Score: **51 / 51 (100%)**


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10 

What fresh gas flow rate is typical of a non-rebreathing anesthetic circuit?

30-50 ml/kg/min	HIDE
50-150 ml/kg/min	HIDE
300-450 ml/kg/min	HIDE
100-300 ml/kg/min	HIDE

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1 

What fre

- 100-300
- 30-50 m
- 300-450
- 50-150

Correct:

Fresh gas flow rates in NON-rebreathing system are HIGH, varying from 100-300 ml/kg/min, depending on your system

. A high flow rate like this will help remove exhaled gases.

In general, NON-rebreathing anesthetic systems use HIGH flows, and are best for SMALL animals under 7 kg.

This system will also work as partial rebreathing with flow rate at or below 130 ml/kg/min.

Refs: Tighe and Brown, Mosby's Comprehensive Review for Vet Techs, 3rd ed. pp. 352-3.

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Which decongestant and anti-cough medicine is also used in anesthetic induction protocols in horses?

Diphenhydramine	HIDE
Guaifenesin	HIDE
Dextromethorphan	HIDE
Acepromazine	HIDE

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PREV

1

Which de
in horses

Diphenh

Guaifene

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Acepron

Correct:

Guaifenesin is an anti-tussive (anti-cough) and decongestant medication that also works as a muscle relaxant.

Guaifenesin is often used to provide a smooth anesthetic induction and maintenance in horses. FYI-In horses, Butorphanol (Torbugesic®) is a commonly used opiate with analgesic (anti-pain) and anti-tussive properties.

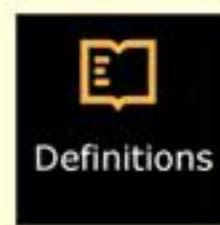
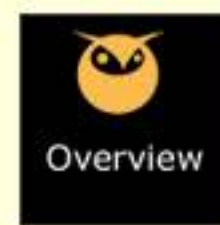
Diphenhydramine is just another name for the antihistamine decongestant Benadryl®, used to treat anaphylaxis (immediate whole-body allergic reaction) in horse.

Dextromethorphan is a cough suppressant, but it is not used to induce anesthesia.

Acepromazine is a sedative, but not a cough suppressant.

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Which of the following correctly describes the phenomenon of allodynia?

A decreased analgesic effect seen in treatment of a painful patient	HIDE
An exaggerated response to painful stimuli is present	HIDE
Stimuli that are not normally painful produce a pain response	HIDE
Species-specific responses to painful stimuli	HIDE
Lack of response to stimuli that usually cause pain	HIDE

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Correct

Stimuli that are not normally painful produce a pain response

Allodynia is pain produced by stimuli that are not normally painful.

Hyperalgesia is an exaggerated response to a painful stimuli. **Hypoalgesia** is a decreased response to a painful stimuli. **Tolerance** is a decreased analgesic effect; seen with use of pain medication.

Both hyperalgesia and allodynia develop with **severe acute pain** and with **chronic pain** where the components of pain pathways become sensitized to painful and eventually non-painful stimuli.

Low-threshold sensory nerve fibers are believed to be involved in the development of both hyperalgesia and allodynia.

Following excessive stimulation from numerous sources, the response patterns of A-delta and C fiber pain receptors gradually change.

Also, A-beta fibers, which normally respond only to innocuous stimuli such as touch, begin responding to painful input.

See the [Taxonomy of Pain](#) from the International Association for the Study of Pain, [Pain Management Guidelines for Dogs & Cats](#) from the Am. Animal Hospital Assoc, and the [Veterinary Anesthesia and Analgesia Support Group](#).

Refs: Gaynor & Muir Handbook of Vet Pain Mgt 2nd ed. pp. 30-9, 57-9, Greene, Vet Anes and Pain Mgt Secrets pp. 323-30, and the Merck Veterinary Manual online edition.

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✓	✗	✓	✓	✓	M ✓				

Why are gas anesthetics not recommended for induction of anesthesia in chelonians (turtles)?

They are exquisitely sensitive to inhalants	HIDE
They take infrequent breaths	HIDE
They have prolonged clearance of inhalants	HIDE
It is difficult to place a mask	HIDE
They are insensitive to inhalants	HIDE

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1

Why are
(turtles)

They are

They take

They have

It is diff

They are insensitive to inhalants

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Correct: They take infrequent breaths

Chelonians tend to have long periods between breaths, making induction of anesthesia via inhalants difficult.

Therefore, anesthesia is usually induced with injectables and then endotracheal tubes are placed for maintenance of anesthesia.

Refs: Bassert and Thomas, McCurnin's Clinical Textbook for Veterinary Technicians, 8th edition, p. 826.

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✓	✗	✓	✓	✓	M ✓				

Which one of the following is the most correct explanation of **how electrical defibrillation works** in patients with cardiac arrest?

Abnormal myocardial cells that are fibrillating are cauterized	HIDE
Shock re-starts all myocardial cells at once, eliminating the unorganized rhythm and poor contractility seen with fibrillation	HIDE
Shock stops all cells in heart simultaneously. Allows pacemaker cells to regain control of myocardial contraction	HIDE
Shock accentuates strength of depolarization wave generated by pacemaker cells. They overwhelm fibrillation waves and restart cardiac rhythm	HIDE

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Which or works in

Shock s regain c

Shock r rhythm

Abnorm

Correct: Shock stops all cells in heart simultaneously. Allows pacemaker cells to regain control of myocardial contraction

Defibrillation is performed with electrical shock to stop the activity of all myocardial cells at once.

Essentially, the heart is put into asystole, to allow the pacemaker cells to regain control of the cardiac rhythm.

Pacemaker cells can produce an effective depolarization and contraction only when the myocardial cells are able to respond.

They must not be actively contracting (or fibrillating) or in a refractory period.

Click here to download Vet Emergency and Critical Care with [CPCR guidelines for animals](#).

Shock accentuates strength of depolarization wave generated by pacemaker cells. They overwhelm fibrillation waves and restart cardiac rhythm

HIDE

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✓	✗	✓	✓	✓	✓	✓			

Which one of the following choices lists a primary difference between sevoflurane and isoflurane?

Sevoflurane is more likely to cause complications in geriatric patients	HIDE
Sevoflurane is more likely to be fetotoxic	HIDE
Sevoflurane has a faster induction and recovery	HIDE
Mask induction with sevoflurane is contraindicated	HIDE
Sevoflurane is more of a respiratory irritant	HIDE

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Which of the following is more of a respiratory irritant than isoflurane?

- Sevoflurane
- Sevoflurane
- Sevoflurane
- Mask inductions

Correct:

Sevoflurane has a more rapid induction and recovery compared to isoflurane. Sevoflurane is a good choice for debilitated and geriatric patients because it is more easily dosed "to effect".

Sevoflurane is less of a respiratory irritant than isoflurane. Mask inductions are better tolerated and faster with sevoflurane.

Fetotoxicity has NOT been seen with sevoflurane in lab animal studies. However, definite safety during pregnancy has NOT been proven.

Refs: Plumb's Veterinary Drug Handbook, 8th edition, *Isoflurane, Sevoflurane*.

Sevoflurane is more of a respiratory irritant HIDE

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When inducing anesthesia with barbiturates like methohexital, premedication with atropine will prevent one of these side effects.

Which side effect is prevented?

Fast heart rate	HIDE
Rapid breathing	HIDE
Slow breathing	HIDE
Slow heart rate	HIDE

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Fast hea
Rapid br
Slow br

Correct: Slow heart rate

Anti-cholinergics like atropine or glycopyrrolate are given as pre-meds to INCREASE heart rate, DECREASE salivation and DECREASE airway secretions.

Remember that many anesthetic drugs (like opiates, barbiturates, gas anesthetics) promote bradycardia (slowed heart rate) and some dissociative anesthetics (like ketamine, tiletamine) cause excessive salivation. and increase intracranial pressure (ICP)

Refs: Plumb's Veterinary Drug Handbook, 7th ed. pp. 126-31, 641-4 and McCurnin & Bassert, Clin Textbook for Vet Technicians, 8th ed. pp. 1080-1.

Slow heart rate HIDE

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Which one of the following choices correctly describes a clinical situation where glycopyrrolate would be preferred over atropine in an anesthetic patient?

Glycopyrrolate doesn't inhibit bronchial secretion, so it is preferred in patients with pneumonia	HIDE
Since glycopyrrolate does not cross blood brain barrier, it is better in febrile patients	HIDE
Glycopyrrolate causes less tachycardia, so it is safe to use in patients with cardiac disease	HIDE
Glycopyrrolate is less likely to cause ileus so it can be used in horses as needed	HIDE
Since it does a better job of decreasing salivation, glycopyrrolate works better in ruminants	HIDE

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1

Which of the following is correct regarding glycopyrrolate?

Glycopyrrolate is contraindicated in patients with

Since glycopyrrolate is contraindicated in patients with

Glycopyrrolate is contraindicated in patients with cardiac disease

- Glycopyrrolate is less likely to cause ileus so it can be used in horses as needed HIDE
- Since it does a better job of decreasing salivation, glycopyrrolate works better in ruminants HIDE

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Correct: Since glycopyrrolate does not cross blood brain barrier, it is better in febrile patients

Atropine should be avoided in **febrile patients** since it crosses the blood brain barrier, where it may interfere with temperature regulation in the hypothalamus.

Both glycopyrrolate and atropine cause ileus in horses, neither should be used routinely.

The myocardium is forced to work harder when patients become tachycardic, so any anticholinergic should be used judiciously in cardiac patients.

Anticholinergics are NOT useful in ruminants because salivation is not significantly decreased.

Both drugs cause drying and thickening of bronchial secretions, so **neither is preferred in patients with pneumonia.**

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Which one of the following anesthetic agents should be avoided for induction in a patient with head trauma?

Ketamine	HIDE
Etomidate	HIDE
Propofol	HIDE
Alfaxalone	HIDE
Thiopental	HIDE

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Which or
with hea

Ketamin

Etomidate

Propofol

Alfaxalone

Thiopental

HIDE

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How do you prevent laryngospasm in cats during induction and maintenance of anesthesia?

Avoid halothane	HIDE
Pre-medicate with acepromazine	HIDE
1-2% Lidocaine spray	HIDE
Pre-medicate with atropine	HIDE

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How do you

Avoid ha

Pre-mec

1-2% Li

Pre-mec

Correct:

Prevent laryngospasm by spraying larynx with 1-2% lidocaine. Laryngeal spasm is primarily a CAT problem associated with overzealous manipulation of the larynx by laryngoscope or during intubation.

AVOID BENZOcaine in cats. Commercial topical preparations of benzocaine (like "Cetacaine") shouldn't be used because of reports of methemoglobinemia associated with their use.


Pigs are also prone to laryngospasm.


Refs: Bassett and Thomas, McCurnin's Clinical Textbook for Veterinary Technicians,

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When is the best time to refill the vaporizer in an anesthetic machine in a small animal clinic?

When the CO2 absorbent granules are completely purple	HIDE
When the fewest people are in the clinic	HIDE
Whenever the fill volume is below 50%	HIDE
Depends on the type of breathing circuit	HIDE
After each surgery	HIDE

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**SAVE & EXIT**

Correct: When the fewest people are in the clinic

The best time to refill the anesthetic vaporizer in a small animal clinic is when the **least number of people are around** that could be exposed to anesthetic vapors that escape into the room.

After filling the vaporizer, it is best to leave the room if possible so that exposure to vapor is minimized.

It is also good to **leave a machine ready** to go **in the evening** for potential emergencies.

In large animal practice – a **full vaporizer being used** on an **adult horse or cow** will need to be **refilled every 2.5-3 hours or so,** because the **volume of inhalant used is so much greater in large animal patients.**

Therefore, exposure is sometimes unavoidable during long procedures.

When is clinic?

When the

When the

Whenever






Depends

After each surgery

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A 12-year-old Warmblood mare has been sedated intravenously with a combination of xylazine and butorphanol for dental evaluation because she has been dropping feed.

You listen to the heart immediately after sedation and note a heart rate of 20 beats per minute [Normal = 28-44 bpm] with an occasional "dropped" beat; the horse is standing quietly.

What is the most appropriate action to take next?

Prepare a dose of naloxone to reverse the butorphanol	HIDE
Prepare a dose of yohimbine to reverse the xylazine	HIDE
Prepare a dose of atropine to increase heart rate	HIDE
Prepare a dose of dobutamine to improve cardiac contractility	HIDE
Nothing; this is a normal response	HIDE

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A 12-year-old horse is sedated with xylazine. You listen to the heart 1 minute later. The horse is quietly. What is the most likely response?

Correct:

Nothing; this is a normal response.

Bradycardia commonly occurs immediately after induction of sedation with alpha-two agonists, such as xylazine, in horses.

This bradycardia is sometimes accompanied by transient second degree atrioventricular block and a decreased respiratory rate.

Atropine is an antimuscarinic agent that increases the heart rate.

It is rarely indicated in these cases and is associated with an increased risk of colic.

Butorphanol is a mixed opioid kappa agonist-mu antagonist and may uncommonly cause bradycardia.

Prepare a dose of dobutamine to improve cardiac contractility	HIDE
Nothing; this is a normal response	HIDE

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20

A 12-year-old horse is sedated with xylazine.

You listen to the heart 1 minute later. The heart rate is 20 bpm and the horse is standing quietly.

What is the most appropriate next step?

Prepare a dose of dobutamine to improve cardiac contractility

Prepare a dose of atropine to increase heart rate

Prepare a dose of epinephrine to increase heart rate

Prepare a dose of norepinephrine to increase heart rate

Nothing; this is a normal response

Prepare a dose of dobutamine to improve cardiac contractility

Prepare a dose of atropine to increase heart rate

Prepare a dose of epinephrine to increase heart rate

Prepare a dose of norepinephrine to increase heart rate

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Opioid reversal with naloxone would not be indicated because the butorphanol is not likely the cause of the bradycardia.

In addition, reversal of a mixed agonist-antagonist is not complete.

The effects of the alpha-2 agonists can be reversed with yohimbine, tolazoline, or atipamezole.

This is unnecessary when the horse is standing quietly with a heart rate of 20 bpm and second degree atrioventricular block.

Dobutamine is a beta-one agonist and increases cardiac contractility with little effect on the heart rate.

Refs: Plumb's Veterinary Drug Handbook, 8th ed. and Bassert and Thomas,

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Which drug can reverse the effects of xylazine (alpha2-adrenergic agonist with analgesic and sedative effects)?

Diazepam (Valium®)	HIDE
Atropine	HIDE
Pralidoxime	HIDE
Yohimbine	HIDE

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Which drug is used for reversal of xylazine and sedation?

- Diazepam
- Atropine
- Pralidoxime
- Yohimbine**

Correct:

Yohimbine is the reversal agent for xylazine. Remember "X goes with Y and Y goes with Z".

Yohimbine is also an antidote for amitraz, the drug used to treat generalized demodicosis.

Remember 2 things about xylazine:

1. Cattle are EXTREMELY SENSITIVE. Cow xylazine dose is about 20 times LESS than dogs or horses
2. Xylazine is used as an EMETIC in CATS, causes vomiting.

Pralidoxime is used to treat organophosphate toxicity, along with a sedative for seizures, diazepam (Valium ®) or pentobarbital) and Atropine.

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There are 5 steps along the pain pathway necessary to alert the patient to a painful stimulus.

Which of the following is the first step, that takes place at the most peripheral pain receptors?

Transmission	HIDE
Transduction	HIDE
Projection	HIDE
Perception	HIDE
Modulation	HIDE

Correct

Transduction is the conversion of a stimulus, usually mechanical, thermal, or chemical, into an electrical signal by pain receptors located on nerve endings in the skin, subcutaneous tissues, viscera, etc.

The electrical impulse is transmitted via afferent sensory nerves to the dorsal horn of the spinal cord.

Response to the painful stimulus is directed here when appropriate, e.g., a withdrawal reflex. It is also amplified, facilitated and/or suppressed here (modulation).

The signal is then projected to higher centers, usually via the spinothalamic or the spinoreticular tracts. Further modulation occurs in the thalamus, reticular formation, and limbic system.

Finally, it reaches the cerebral cortex, where the perception occurs, and physical and emotional responses are produced.

See very good overviews of pain physiology:

[An introduction to pain pathways and mechanisms](#) by Danielle R, Curran N and Stephens R, from University College London Hospital, UK.

Lamont LA, DVM, Tranquilli WJ, & Grimm KA. 2000. Physiology Of Pain. *Vet Clinics of NA: Small Animal Practice*;30(4): 703-28.

Refs: Gaynor & Muir Handbook of Vet Pain Mgt 2nd ed. pp. 17-9, Greene, Vet Anes and Pain Mgt Secrets pp. 335-7 and the Merck Veterinary Manual online edition.

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A cat is anesthetized for ovariohysterectomy (OHE) with isoflurane in oxygen after premedication with atropine, acepromazine, and hydromorphone intramuscularly, and induction with midazolam and ketamine intravenously.

As the surgeon exteriorizes the first ovary for ligation, the cat's heart rate, blood pressure, and respiratory rate begin to increase rapidly, but she does not move.

Which of the following is the next best step?

Increase the isoflurane vaporizer setting	HIDE
Raise the inspired oxygen flow rate to a higher setting	HIDE
Put the cat on a ventilator	HIDE
Administer a dose of dexmedetomidine intramuscularly	HIDE

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Correct

Increase the isoflurane vaporizer setting.

This cat is **lightly anesthetized** and **anesthetic depth should be increased**.

The simplest way to increase depth in this patient is to **increase the** isoflurane setting and manually ventilate the cat for a short time.

Surgical stimulation raises sympathetic tone, **which increases** heart rate (HR), blood pressure (BP), and respiratory rate (RR).

Anesthetic depth is adjusted in proportion to the intensity of surgical stimulation.

Increases in HR, RR, or BP do not necessarily mean the patient feels pain as awareness is lost before the autonomic response to surgery.

Response during OHE is common at the skin incision, and with tension on the ovarian ligaments or uterus.

If high levels of inhalant are needed or the BP drops too low, a dose of an analgesic or sedative may be necessary. This can help to maintain the patient on a lower percent of inhalant.

Refs: McCurnin's Clin Textbk for Vet Techs, 8th ed. pp. 1107, Thomas & Lerche Vet Anes and Analgesia for Vet Techs, 4th ed. pp. 142-3, 177 and the Merck Veterinary Manual online edition.

Heart Rate and the Electrocardiogram

The heart beats because of a wave of depolarization that originates in the sinoatrial (SA) node at the juncture of the cranial vena cava and the right atrium. **At rest**, the SA node discharges ~30 times/min in horses, >120 times/min in cats (typically 180–220 times/min in a hospital setting), and 60–120 times/min in dogs, depending on their size. **In general**, the larger the species, the slower the rate of SA node discharge and the slower the heart rate. Birds can have a resting heart rate of ~115–130 beats/min, with active heart rates up to 670 beats/min, depending on size and species. Hummingbirds can have an active heart rate of >1,200 beats/min.

The rate of SA nodal discharge increases when norepinephrine is released from the sympathetic nerves and **binds to the β_1 -adrenoreceptors on the SA node**. This **cardioacceleration** may be blocked by β -adrenergic blocking agents (eg, propranolol, atenolol, metoprolol, esmolol, carvedilol). **The rate of SA nodal discharge decreases when acetylcholine released by the parasympathetic (vagus) nerves binds to the cholinergic receptors on the SA node**. This vagally mediated cardiodeceleration may be **blocked by a parasympatholytic** (vagolytic) compound (eg, atropine, glycopyrrolate). When **the SA node discharges and the wave of depolarization traverses the atria, the P wave of the ECG is produced**. Subsequently, the atria contract, ejecting a small volume of remaining blood into the respective ventricles (atrial kick). In quiet, healthy dogs, the variation of the heart rate with respiration is termed **respiratory sinus arrhythmia (RSA)**; it results from decreased vagal activity during inspiration and increased vagal activity during expiration. Therefore, vagolytic compounds, as well as excitement, pain, fever, and congestive heart failure (CHF), usually abolish or diminish RSA. Heart rate variability synchronized with respirations is a good indicator of cardiac health. **It is rare to find an animal that has active CHF with RSA**; however, comorbid conditions that increase vagal activity (such as primary respiratory or neurologic disease) may cause RSA to persist.


Heart rate is also inversely related to systemic arterial blood pressure. When blood pressure increases, heart rate decreases; when blood pressure decreases, heart rate increases. This relation is known as the Marey reflex and occurs by the following mechanism. When high-pressure arterial baroreceptors in the aortic and carotid sinuses detect increases in blood pressure, they send increased afferent volleys to the medulla oblongata, which increases vagal efferents to the SA node and causes the heart rate to decrease. **In heart failure**, the **baroreceptors** (laden with Na⁺/K⁺-ATPase) become fatigued, which reduces the afferent signals to the medulla oblongata. This results in less vagal efferent signaling. Thus, dogs in CHF have a decrease in heart rate variability and frequently present with an underlying sinus tachycardia.


Once the wave of depolarization reaches the atrioventricular (AV) node, the speed of conduction is slowed through the nodal tissue, giving the atria time to contract and eject more blood into the

ventricles, allowing for atrioventricular synchrony. The depolarization then travels rapidly to the subendocardium of the ventricles and to the ventricular septum. From these points, it travels slowly through the ventricular myocardium, producing the QRS complex of the ECG with subsequent ventricular contraction. The delay between the electrical activity visualized on ECG and mechanical function accounts for transmission of impulses, which allows contraction of myocytes to occur in synchrony. Under rare conditions, there may be **depolarization without contraction**; this is called **electromechanical dissociation**.

The interval on an ECG between the onset of the P wave and the onset of the QRS complex is termed the **PQ** or **PR interval**. It is a measure of the time it takes for the electrical wave of depolarization to begin at the SA node and reach the ventricles (lastly traversing the AV node). **Factors that speed or slow the rate of discharge of the SA node (chronotropy) also speed or slow conduction through the AV node (dromotropy)**. Thus, as the heart rate increases, the PR interval shortens; when heart rate slows, the PR interval lengthens.

The T wave of the ECG represents repolarization of the ventricles. It is affected by electrolyte imbalance (eg, hypo- or hyperkalemia, hypo- or hypercalcemia), myocardial injury, or ventricular enlargement. **Repolarization of the atria (Ta wave)** is **rarely seen, because it occurs during the much larger QRS complex**. Occasionally, **it can be seen with AV nodal disease (AV block)** or in horses with slow heart rates, **appearing as a “hammock” after the P wave**.

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What part keeps exhaled gasses moving away from the patient in a circular rebreathing anesthetic delivery system?

One-way valves	HIDE
Y-valve on endotracheal tube	HIDE
Rebreathing bag	HIDE
Oxygen flush valve	HIDE

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 **11**

Correct:

One way valves help direct gas flow. Expired gasses pass through a CO₂ scavenger canister to remove CO₂.

STRATEGY HINT: See how the word **"Valve"** occurs in 3 choices? Chances are that the correct answer contains this word.

Refs: McCurnin & Bassert, Clin Textbook for Vet Technicians, 8th ed. pp. 1094-5, fig 29-14.

One-way

Y-valve

Rebreater

Oxygen

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Which drug causes vomiting in cats?

Ketamine	HIDE
Xylazine	HIDE
Diazepam	HIDE
Phenobarbital	HIDE

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Correct

Xylazine is used as an EMETIC in CATS, causes vomiting.

Three things to remember about xylazine:

1. Cattle are EXTREMELY SENSITIVE to xylazine. For example, cattle need only 1/10th the dose of xylazine used in horses.
2. Reversed with yohimbine, atipamezole, or tolazoline.
3. Pretreatment with Atropine can decrease bradycardia, hypersalivation seen with xylazine in cattle.

Two ANTI-emetics in cats are **diphenhydramine** (Benadryl®), and **metoclopramide**.

Refs: Plumb's Veterinary Drug Handbook, 7th ed. pp. 1397-1402, Bassett and Thomas, McCurnin's Clinical Textbook for Veterinary Technicians, 8th ed pp. 1079-80.

Which drug is used as an emetic in cats?

Ketamine


Xylazine

Diazepam


Phenobarbital

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Hypotension and sedation are characteristic effects of which one of the drugs listed below?

Acepromazine	HIDE
Phenazopyridine	HIDE
Phenylephrine	HIDE
Dobutamine	HIDE
Maropitant	HIDE

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Hypoten:

Acepron

Phenazo

Phenyle

Dobutar

Maropitant

Acepromazine causes **vasodilation by blocking alpha-1 receptors** in peripheral vasculature, producing **hypotension**.

A **phenothiazine tranquilizer**, **acepromazine** is both a **dopamine and alpha-1 receptor antagonist**. It works very well as a sedative in small animals, takes **20-30 minutes** to take effect, and **lasts 3-4 hours** at clinical doses.

The behavioral and sedative effects are produced by a **decrease in dopamine secretion in the basal ganglia and the limbic system in the brain**. It blocks dopamine receptors in the chemoreceptor trigger zone of the medulla to produce its anti-emetic effect.

Maropitant is an **antiemetic** used in dogs, not associated with **hypotension**.

Dobutamine and **phenylephrine** both act to increase blood pressure.

Phenazopyridine is a urinary tract analgesic.

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Which anesthetic breathing system has the highest fresh gas flow rate during maintenance of anesthesia?

Partial rebreathing	HIDE
Closed system	HIDE
Semi-closed system	HIDE
Nonrebreathing	HIDE

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21

Which are types of anesthetic systems?

- Partial rebreathing
- Closed system
- Semi-closed system
- Nonrebreathing**

Correct:

In **NONrebreathing systems**, there is NO remixing of inhaled and exhaled gasses. These systems run at HIGH fresh gas flow rates, **100-300 ml/kg/min**.

A **closed anesthetic rebreathing system** only provides enough fresh gas flow to meet an animal's metabolic needs, about **5-10 ml/kg/min** (depending on animal size. Flow is lower for larger animals and higher for smaller animals).

Semi-closed and partial rebreathing systems are the same thing. They run at intermediate flow rates where fresh gas is delivered in excess of metabolic consumption, from about **10 ml/kg/min (large animals)** or **30 ml/kg/min (small animals)**.

Refs: Bassett and Thomas, McCurnin's Clinical Textbook for Veterinary Technicians,

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A young female dog **under inhalant anesthesia** for ovariohysterectomy has the following blood gas findings.

Which one of the following choices is the most accurate interpretation of these findings?

Value	Normal	(ABG) Arterial Blood Gas Analysis is used to measure
PaCO ₂ = 78.7 mm Hg	29-42 mm Hg	1- partial pressures carbon dioxide (PaCO ₂)
HCO ₃ = 33.7 mm Hg	17-24 mm Hg	2- bicarbonate
PaO ₂ = 402.4 mm Hg	85-95mm Hg without oxygen supplementation	3- partial pressures of oxygen (PaO ₂)
pH = 7.24	7.31-7.42	

Which one of the following choices is the most accurate interpretation of these findings?

Value	Normal	(ABG) Arterial Blood Gas Analysis is used to measure
PaCO ₂ = 78.7 mm Hg	29-42 mm Hg	partial pressures carbon dioxide (PaCO ₂)
HCO ₃ = 33.7 mm Hg	17-24 mm Hg	bicarbonate
PaO ₂ = 402.4 mm Hg	85-95mm Hg	without oxygen supplementation partial pressures of oxygen (PaO ₂)
pH = 7.24	7.31-7.42	

Metabolic acidosis due to fluid loss	HIDE
Metabolic acidosis due to intravenous potassium supplementation error	HIDE
Hypoventilation leading to respiratory acidosis	HIDE
Respiratory alkalosis resulting from too-frequent mechanical ventilation	HIDE
Metabolic alkalosis due to H ⁺ sequestration	HIDE

Correct Hypoventilation leading to respiratory acidosis

Hypoventilation under anesthesia leading to respiratory acidosis is the most likely explanation for the findings on this dog.

DEcreased pH=acidosis and INcreased PaCO₂ with INcreased HCO₃⁻ indicates primary respiratory acidosis with renal compensation.

Notice that although there is compensation the pH is not completely normalized (it takes time).

PaO_2 is higher than the reference range for an animal breathing room air despite hypoventilation because a dog under inhalant anesthesia is breathing nearly 100% oxygen.

PaO_2 is expected to be closer to 500 mm Hg with oxygen supplementation under anesthesia.

Appropriate mechanical ventilation should correct the increased PaCO_2 and acidemia quickly.





Refs: See this informative article in [dvm360](#) and this helpful reference on the Cornell University [eclinpath website](#).

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Why are atropine or glycopyrrolate (anti-cholinergics) often given as a premedication to dogs and cats before inducing anesthesia with ketamine or tiletamine? (Dissociative anesthetics)

Slows the heart rate	HIDE
Increase airway secretions	HIDE
Helps keep eyes closed	HIDE
Decrease salivation	HIDE

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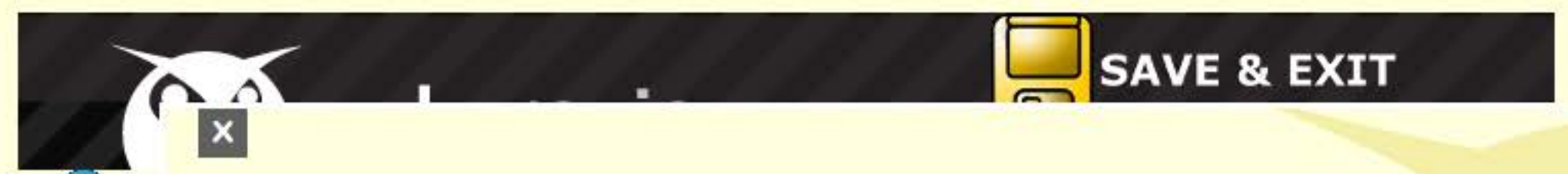
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Why are dogs and anesthet

- Slows th
- Increase
- Helps ke

Correct: Decrease salivation

Anti-cholinergics like atropine or glycopyrrolate are given as pre-meds to **DECREASE salivation**, **DECREASE airway secretions** and **INCREASE heart rate**.

They do NOT affect whether eyes are open or closed, but they do **DILATE the pupils**.

Remember that many anesthetic drugs (**like opiates, barbiturates, gas anesthetics**) promote **bradycardia** (slowed heart rate) and some dissociative anesthetics (like **ketamine, tiletamine**) cause **excessive salivation**.

Refs: Plumb's Veterinary Drug Handbook, 7th ed. pp. 126-31, 641-4 and Bassert and Thomas, McCurnin's Clinical Textbook for Veterinary Technicians, 8th ed. pp. 1080-1.

Decrease salivation HIDE

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Ketamine is contraindicated for dogs having history of which problem?

Epilepsy	HIDE
Bradycardia	HIDE
Polyuria, polydipsia	HIDE
Decreased intraocular pressure	HIDE

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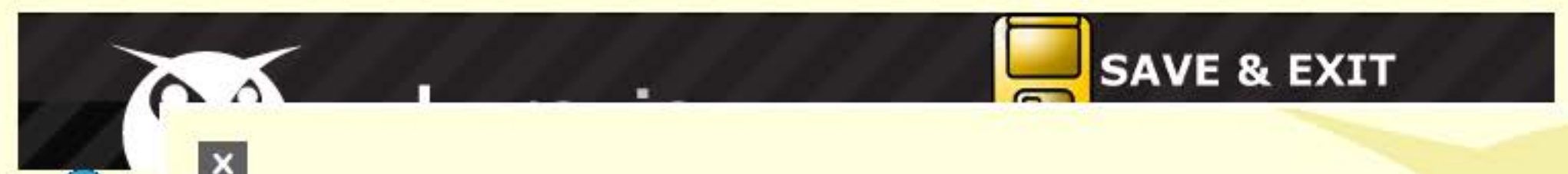
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- 21 x
- Ketamine
- Epilepsy
- Bradycardia
- Polyuria
- Decreased

Correct: Epilepsy

Ketamine can cause seizures in some dogs (epilepsy is a form of seizure). Ketamine is contraindicated (do not use it) in dogs with increased intra-ocular pressure (like glaucoma) and can cause respiratory depression.

Other contraindications include prior hypersensitivity reactions, animals to be used for human consumption, use of ketamine alone for general anesthesia and increased CSF pressure or head trauma.

Remember to protect a cat's eyes with ophthalmic ointment when using ketamine, because they remain open after injection.

Refs: Plumb's Veterinary Drug Handbook 7th ed. pp. 762-9 and the Merck Veterinary

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Which animal is most sensitive to the effects of the sedative Xylazine (Rompun®)?

Pig	HIDE
Cow	HIDE
Dog	HIDE
Horse	HIDE

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21

Which are

- Pig
- Cow**
- Dog
- Horse

x

Correct:

Cattle are EXTREMELY SENSITIVE to xylazine. Cow dose is about 20 times LESS than dogs or horses Two things to remember.

1. Reversed with YOHIMBINE.
2. Pretreatment with Atropine can decrease bradycardia, hypersalivation seen with xylazine in cattle.

Refs: Plumb's Veterinary Drug Handbook, 7th ed. pp. 1397-1402 and Bassert and Thomas, McCurnin's Clinical Textbook for Veterinary Technicians, 8th ed pp. 1079-80.

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Of the following large animals, which one is the **most sensitive** to the sedative effects of xylazine?

Equine	HIDE
Alpaca	HIDE
Llama	HIDE
Swine	HIDE
Bovine	HIDE

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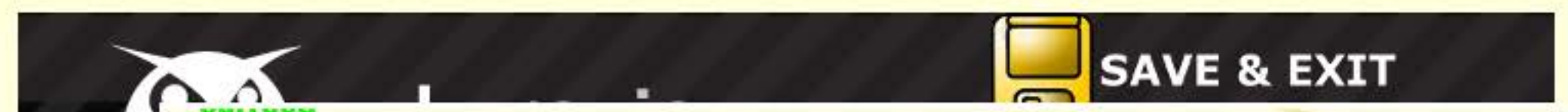












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Of the fo
xylazine

Bovine

Alpaca

Equine

Llama

Swine


HIDE

Ruminants are the large animals most sensitive to the sedative effects of xylazine (an alpha-2 agonist), followed by camelids, equine, and then swine. Cattle require approximately 1/10th the dose of xylazine used in horses.


Lower doses produce sedation without recumbency; higher doses produce profound sedation and recumbency. Some cattle breeds (Brahma, Hereford) require lower doses than others (Holstein). Alpacas usually require a bit higher dose than llamas.

The addition of an opioid such as butorphanol provides profound sedation and analgesia and allows the use of lower doses of xylazine.

Since ruminants and camelids regurgitate normally when awake, this can occur passively when sedated. The head and neck should be positioned such that aspiration is avoided while recumbent. Tracheal intubation is recommended whenever possible especially for long procedures.



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 **21**

Of the fo
xylazine

Bovine

Alpaca

Equine

Llama

Swine

HIDE

especially for long procedures.


The effects of the **alpha-2 agonists** can be **reversed with yohimbine**, tolazoline, or atipamezole. Equine and camelids are quite sensitive to tolazoline.


Swine respond poorly to xylazine when used alone, and often still vocalize and respond to manipulation even when ketamine is added. Use of the more potent **alpha-2, medetomidine, combined with a benzodiazepine and an opioid, (e.g., midazolam and butorphanol, respectively)** improves sedation dramatically in swine.


Refs: Tranquilli, Thurmon, and Grimm's Lumb & Jones Veterinary Anesthesia, 4th ed., pp. 722-3, Muir, Hubbell, Bednarski, and Skarda's Handbook of Veterinary Anesthesia, 4th ed., pp. 412-20.


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A 50 lb mixed breed **dog** is heavily **sedated** with **dexmedetomine** and **butorphanol** given intravenously for repair of a laceration.


His mucous membranes are pale, capillary refill time is 2 seconds, heart rate is **56 beats** per minute [N=70-120 bpm], respiratory rate is **10 breaths** per minute [N=18-34 brpm].


Which of the following is the next best step?

- | | |
|--|------|
| Give an anti-cholinergic intramuscularly for the slow heart rate | HIDE |
| No treatment is necessary, this is normal with alpha 2 agonists | HIDE |
| Perform an electrocardiogram to determine the type of bradycardia | HIDE |
| Place an intravenous catheter and bolus 10 ml/kg of lactated ringers | HIDE |

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A 50 lb r
intravenc


His muc
minute [

Which of

Give an

No treat

Perform



Correct: No treatment is necessary, this is normal with alpha 2 agonists

Bradycardia is a very common side effect of alpha-2 agonists in all species.

It is a reflex, a baroreceptor response to the initial hypertension that is caused by intense vasoconstriction. The hypertension causes a reflex increase in vagal tone, which slows the heart rate.

In this case, the low HR should not automatically be treated, as this would further increase BP and the workload of the heart. If the HR gets too slow or very dysrrhythmic, or BP drops too low, reversal with atipamezole is indicated.

Refs: McCurnin's Clin Textbk for Vet Techs 8th ed pp 1082-3 1104 Thomas &

Place an intravenous catheter and bolus 10 ml/kg of lactated ringers

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Which drug is often used to control epilepsy (idiopathic seizures), when common metabolic and toxic causes have been ruled out?

Pentobarbital	HIDE
Secobarbital	HIDE
Methohexital	HIDE
Phenobarbital	HIDE

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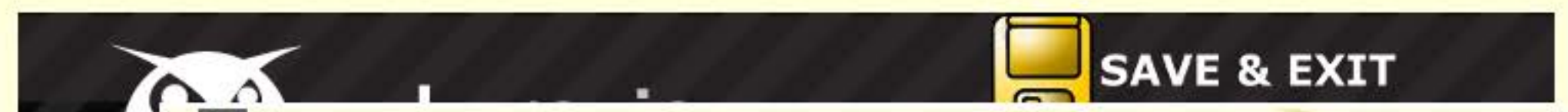
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Which drug is most likely to cause hypotension and toxic effects?

Pentobarbital

Secobarbital

Methohexital

Phenobarbital

Correct:

These drugs are **all barbiturates**. Think of **PHENObarb** to control epilepsy/seizures. Can see agitation/excitement at first, or profound depression, so need to monitor.

Methohexital is an ultra-short-acting barbiturates used to **induce anesthesia**. **Pentobarbital and secobarbital** are used primarily as **euthanasia** agents today.

Refs: Bassert and Thomas, McCurnin's Clinical Textbook for Veterinary Technicians, 8th ed p. 1085, Plumb's Veterinary Drug Handbook, 7th ed. pp. 145, 893-5, 1306-9 and Tighe & Brown, Mosby's Comprehensive Review for Vet Techs, 2nd ed. pp. 300-1.

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x	✓	M x	✓	x	✓	✓	M ✓	✓	

Nociception is correctly defined by which of the following choices?

Modulation of painful stimuli in the spinal cord prior to transfer to the thalamus	HIDE
Transduction of pain stimuli by nociceptors	HIDE
The physiologic process that results in the perception of pain	HIDE
Transmission of information from pain receptors to the brain	HIDE
Perception of painful sensations processed by peripheral nerve endings	HIDE

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PREV

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Nocicept

Percepti

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Transdu

Modulation of painful stimuli in the spinal cord prior to transfer to the

thalamus

Correct:

The **physiologic process** that results in the perception of **pain** is nociception.

Nociception includes:

- 1) The initial reception and *transduction* of a painful stimulus by specialized **afferent nerve endings** called **nociceptors**
- 2) *Transmission* via **afferent sensory nerves to the spinal cord**
- 3) Processing or *modulation* of the signal in the spinal cord
- 4) *Projection* to the thalamus and cortex of the brain, where the signal(s) are integrated, resulting in
- 5) *Perception*

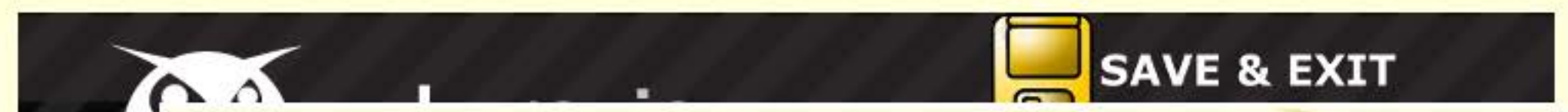
The response to nociception is both physiologic and behavioral, and can be


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The response to **nociception** is both **physiologic and behavioral**, and can be involuntary or voluntary. For example, tachycardia, reflex withdrawal of a limb, vocalization, and moving away or hiding are all responses to painful stimuli.

Note: **some sources omit projection, or call it central transmission of pain signals.**

See the [Taxonomy of pain](#) from the IASP, and [Pain Management Guidelines for Dogs & Cats](#) from the Am. Animal Hospital Assoc., and the Am. Assoc. of Feline Practitioners.

Refs: Gaynor & Muir Handbook of Vet Pain Mgt 2nd ed. pp. 14-30, 58, Greene, Vet Anes and Pain Mgt Secrets, pp. 323-7, and the Merck Veterinary Manual online edition.

Modulation of painful stimuli in the spinal cord prior to transfer to the thalamus

HIDE

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In which animal would it be **best to use glycopyrrolate** as an anesthetic pre-medication, rather than Atropine?

Diabetics	HIDE
Pregnant animals	HIDE
Pigs	HIDE
Obese animals	HIDE

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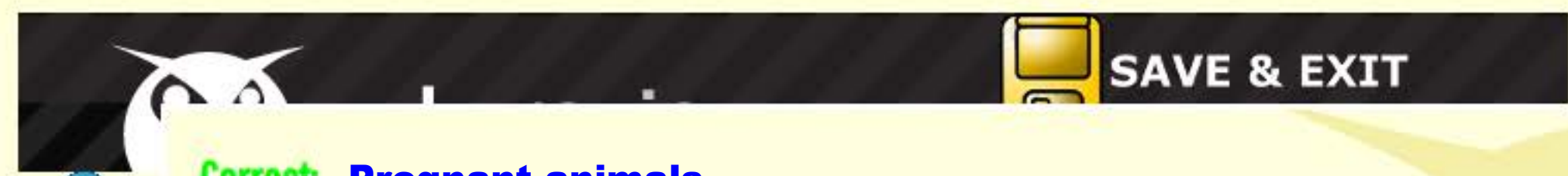
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- In which rather th
- Diabetic
- Pregnant**
- Pigs
- Obese a

Correct: Pregnant animals

Glycopyrrolate crosses the placenta only marginally, so it is a better choice for pregnant animals (unlike atropine, which crosses more easily). This situation is likely to arise if you are doing a cesarean section.

Anti-cholinergics like Atropine or Glycopyrrolate, are given as pre-meds to INCREASE heart rate, DECREASE salivation and DECREASE airway secretions.

Remember that many anesthetic drugs (like opiates, barbiturates, gas anesthetics) promote bradycardia (slowed heart rate) and some dissociative anesthetics (like ketamine, tiletamine) cause excessive salivation.

Refs: Plumb's Veterinary Drug Handbook, 7th ed. pp. 126-31, 641-4, Bassert and

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Which drug is best for fast anesthetic induction in a greyhound?

Phenobarbital	HIDE
Pentobarbital	HIDE
Methohexital	HIDE
Thiopental	HIDE

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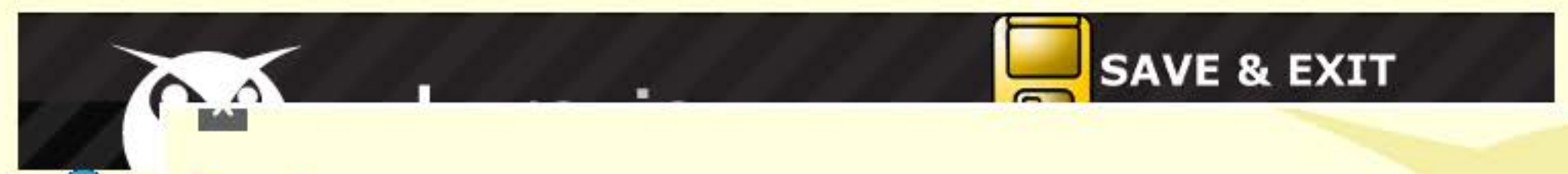
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Which drug is the best choice for anesthesia in a large dog with a history of seizures?

- Phenobarbital
- Pentobarbital
- Methohexital**
- Thiopental

Correct: Methohexital

Really fat animals and sighthounds (like greyhounds, afghans) have trouble excreting barbiturates like the 4 choices here.

Methohexital is a better choice for both because it does not absorb into fat and quickly induces anesthesia. (McCurnin & Bassett note alternatively could use propofol in sight hounds). Beware of RESPIRATORY DEPRESSION with barbiturates.

Thiopental is an ultra-short-acting barbiturate that CAN be stored in fat and slowly released. It is not currently available in the U.S.

Think of **euthanasia** with **PENTO**barb.
Think of **PHENO**barb to **control epilepsy/seizures**.

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You are asked to set up a **non-rebreathing anesthetic circuit** for the next surgery case.

What kind of patient do you expect?

Greyhound with no body fat	HIDE
Siamese cat over 20 lbs	HIDE
Asthmatic bulldog	HIDE
Miniature poodle under 7 kg	HIDE

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Correct:

A non-rebreathing anesthetic circuit is better for SMALLER animals, under 7 kg (under 15 pounds).

Refs: Bassert and Thomas, McCurnin's Clinical Textbook for Veterinary Technicians, 8th ed. pp. 1094-5.

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Greyhound

Siamese

Asthma

Miniature poodle under 7 kg

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Which one of the following regional nerve blocks does not affect sensory function but blocks motor function of the upper eyelid, and is indicated to allow complete ophthalmic examination in the horse?

Supraorbital	HIDE
Zygomatic	HIDE
Auriculopalpebral	HIDE
Ocular	HIDE
Frontal	HIDE

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Which or motor fu examina

Supraor

Zygoma

Auriculo

Ocular

Frontal

Correct:

The auriculopalpebral nerve, located along the dorsal zygomatic arch of the eye, provides motor innervation to the upper orbicularis oculi muscle.

Anesthesia of this nerve prevents the horse from being able to blink the eye and facilitates complete ophthalmic examination.

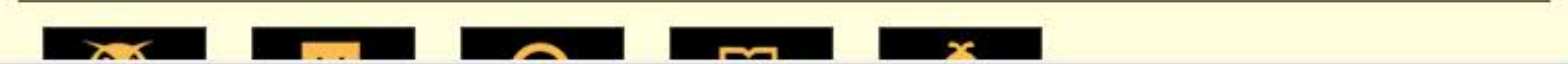
The frontal nerve is a branch of the trigeminal nerve and provides sensory innervation to the upper eyelid.

[Click here](#) to see a good summary on ophthalmology surgical emergencies in horses, with images, courtesy of the American College of Veterinary Surgeons (ACVS).

Refer: Smith, Large Animal Internal Medicine, 4th ed, pp. 702-8 and the Merck

Ocular	HIDE
Frontal	HIDE

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Why would isoflurane be a good anesthetic choice in a patient with kidney and liver disease?

Isoflurane is rapidly metabolized by the liver and kidneys	HIDE
Isoflurane has a very high mean alveolar concentration (MAC) of 6%	HIDE
Isoflurane has a high solubility coefficient	HIDE
Isoflurane can be used without a precision vaporizer	HIDE
Isoflurane is primarily excreted via the lungs	HIDE

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Correct

Isoflurane is primarily excreted via the lungs. Only about 0.2% is removed via metabolism.


Since metabolism is not required for removal, patients with liver or kidney disease can be anesthetized with isoflurane and recovery should not be prolonged.

However, isoflurane and the other newer inhalant anesthetics DO have some effects on the kidney or liver.


Decreased glomerular filtration and urine production can occur with inhalant anesthetics, and this can be exacerbated if hypotension occurs or if nephrotoxic drugs are used. Hepatic blood flow is usually maintained, but can also be impaired if hypotension develops.


Good anesthetic management with attention to blood pressure and oxygenation are essential to prevent most complications.


Isoflurane is primarily excreted via the lungs




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Which anesthetic circuit does not allow mixing of inhaled and exhaled gasses?

Closed circuit	HIDE
To and fro system	HIDE
Circle rebreathing circuit	HIDE
Semi-closed circuit	HIDE
Bain circuit at 200-300 ml/kg/min	HIDE

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Which are the following types of breathing systems?

Closed circuit

To and from

Circle rebreathing

Semi-closed

Correct: **Bain circuit at 200-300 ml/kg/min**

A Bain anesthetic circuit running at a high flow rate of 200-300 ml/kg/min will not allow rebreathing of exhaled gasses. Remember that a Bain system is like a tube within a tube.

New oxygen and anesthetic gas is inhaled down the inner tube, and exhaled gas exits through the outer tube.

At lower flow rates (ie: 130-200 ml/kg/min or less) the Bain functions as a PARTIAL rebreathing system, and the animal rebreathes some of the exhaled gasses.

The other 3 systems are RE-breathing systems. They are closed or semi-closed, meaning they exhalation as much as possible and allow the animal to rebreathe the gas.

Bain circuit at 200-300 ml/kg/min

HIDE

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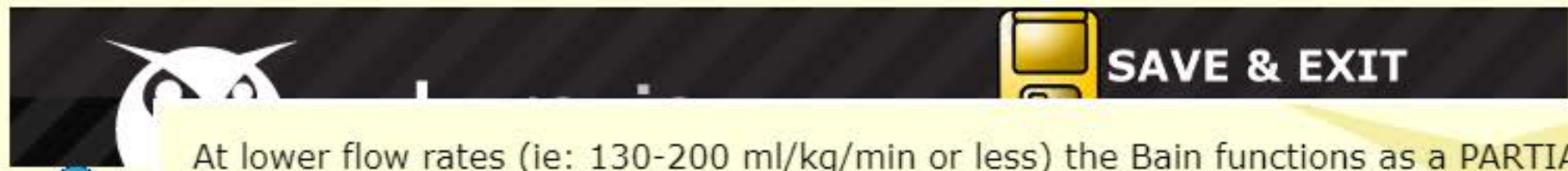
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Which are

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Semi-cl

Bain circuit at 200-300 ml/kg/min

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At lower flow rates (ie: 130-200 ml/kg/min or less) the Bain functions as a PARTIAL rebreathing system, and the animal rebreathes some of the exhaled gasses.

The other 3 systems are RE-breathing systems. They are closed or semi-closed, meaning they only give as much oxygen and gas as the animal metabolically needs for anesthesia.

Closed systems run at MUCH LOWER flow rates around 2-10 ml/kg/min. Semi-closed systems run at around 10 ml/kg/min (lg animals) or 30 ml/kg/min (small animals).

Refs: Bassert and Thomas, McCurnin's Clinical Textbook for Veterinary Technicians, 8th ed. pp. 1094-5.

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Salivation stops in most animals under inhalant general anesthesia.

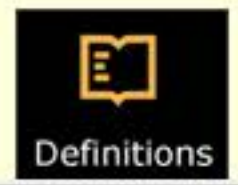
Which one of the following animals CONTINUES to salivate regardless of the drugs used?

Canine	HIDE
Feline	HIDE
Bovine	HIDE
Equine	HIDE

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31 

Salivatio

Which or

Canine

Feline

Bovine

Equine

Correct:

Ruminants and camelids continue to salivate under sedation or anesthesia, even when anti-cholinergics are given.

This is why it is important to intubate ruminants and camelids during inhalent anesthesia and to position the nose down so that the saliva can drain away from the pharynx.

These species also regurgitate rumen fluid under anesthesia, especially during light or deep anesthesia, so be aware of this possibility.

Regurgitation can be active or passive; it is active when they are light and esophageal contractions occur. It is generally passive when they are very relaxed and adequately anesthetized.

For more, see [Anesthetic Monitoring](#) by Lyon Lee DVM, PhD.

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Which one of the following choices correctly pairs the drug listed with its receptor and action?

Propofol - gamma-amino butyric acid (GABA) receptor antagonist - general anesthesia	HIDE
Atipamezole - alpha-2 receptor - antagonist	HIDE
Butorphanol - mu receptor agonist - analgesia	HIDE
Acepromazine - dopamine receptor agonist - sedation	HIDE
Detomidine - beta-1 agonist - sedation	HIDE

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Which of the following is the correct action?

Propofol is a general anesthetic that enhances the activity of the GABA receptor.

Atipamezole is an alpha-2 receptor antagonist, used to reverse the effects of drugs such as xylazine, medetomidine, dexmedetomidine, detomidine, and romifidine. Other alpha-2 antagonists include yohimbine and tolazoline.


Butorphanol is a opioid drug that is a kappa receptor agonist but a mu receptor antagonist.


Acepromazine is a sedative drug that antagonizes dopamine receptors in the brain.

Detomidine is an alpha-2 receptor agonist that produces profound sedation, used mostly in horses.

- Acepromazine - dopamine receptor agonist - sedation HIDE
- Detomidine - beta-1 agonist - sedation HIDE

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Which anesthetic breathing system has the lowest fresh gas flow rate during maintenance of anesthesia?

Closed system	HIDE
Semi-closed system	HIDE
Nonrebreathing	HIDE
Partial rebreathing	HIDE

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Correct:

A closed anesthetic rebreathing system only provides enough fresh gas flow to meet an animal's metabolic needs, about 5-10 ml/kg/min (depending on animal size. Flow is lower for larger animals and higher for smaller animals).

Semi-closed and partial rebreathing systems are the same thing.

They run at intermediate flow rates where fresh gas is delivered in excess of metabolic consumption, from about 10 ml/kg/min (large animals) or 30 ml/kg/min (small animals).

In nonrebreathing systems, there is NO remixing of inhaled and exhaled gasses.

These systems run at HIGH fresh gas flow rates, 100-300 ml/kg/min.

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31

Which are anesthetic systems?

Closed system


Semi-closed system


Nonrebreathing system

Partial rebreathing system

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Of the following, which type of medication is the most effective analgesic available for treatment of acute pain in dogs and cats?

Corticosteroids	HIDE
Opioids	HIDE
Alpha 2 agonists	HIDE
Non-steroidal anti-inflammatories	HIDE
Benzodiazepenes	HIDE

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Of the following treatment options, which is the most effective analgesic available for treatment of acute pain in many animals, including dogs and cats?

- Corticosteroids
- Opioids
- Alpha 2 agonists
- Non-steroidal anti-inflammatory drugs
- Benzodiazepenes HIDE

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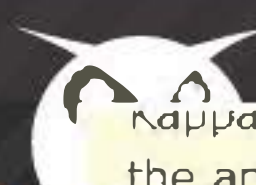


Correct:
Opioids are the most effective analgesics available for treatment of acute pain in many animals, including dogs and cats.

Mu receptor opioid agonists (morphine, oxymorphone, hydromorphone, etc) are the most potent and effective, especially for short term therapy.

Side effects such as sedation, dyphoria, and constipation limit long term use in most patients.

Kappa receptor agonists, such as butorphanol, have fewer adverse side effects but the analgesic effect is weaker and duration is short.



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Kappa receptor agonists, such as butorphanol, have fewer adverse side effects but the analgesic effect is weaker and duration is short.

Alpha-2 agonists are good analgesics, but they also produce sedation and have significant adverse cardiovascular effects. Benzodiazepenes do not provide analgesia when used alone.

The negative endocrine and immune effects of corticosteroids limit their use for pain. Non-steroidal anti-inflammatories are good for mild/moderate acute/chronic pain with close monitoring of renal and gastrointestinal function.

Refs: Gaynor & Muir Handbook of Vet Pain Mgt 2nd ed. pp. 162-84, Greene, Vet Anes and Pain Mgt Secrets pp. 335-44 and the Merck Veterinary Manual online edition.

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Of the fo
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Corticoids

Opioids

Alpha 2


Non-ste


Benzodiazepenes

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Which of the following most correctly describes **neuropathic pain**?

The sensation that results when nociceptors are activated	HIDE
Amplification of the peripheral pain response	HIDE
Pain that results when homeostasis is disturbed, as when disease is present	HIDE
Intense discomfort caused by stretching, tension, or inflammation of viscera	HIDE
A painful response caused by damage to neural tissue	HIDE

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Correct: A painful response caused by damage to neural tissue

Neuropathic pain (NP) is a painful response caused by damage to neural tissue. Axons, cell bodies, and the myelin sheath of nerve fibers located peripherally or centrally may all be affected.

NP results from direct injury to nerve tissue, or occurs indirectly following the inflammatory and neurochemical response to injury of non-neural tissue.


Humans describe NP as shooting or stabbing pain, often with a continuous burning sensation. It is most often seen in patients with chronic pain, but recent information suggests it develops with acute pain also.

Sensitization occurs such that hyperalgesia (a heightened response to painful stimuli) and allodynia (pain response to stimuli that are not normally painful) both develop and last long after the initial injury is healed.

A painful response caused by damage to neural tissue

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Neuropathic pain is possible but does not occur in all patients with neuropathy.


Many medications have been used to treat NP - [gabapentin](#), originally developed and used for seizures, is used often.

See proceedings article on [Neuropathic pain in veterinary patients](#) by Dr. Mark Epstein, and an excellent review : Mathews KA. 2008. Neuropathic Pain in Dogs and Cats: If Only They Could Tell Us If They Hurt. *Vet Clin of NA, SA Practice*; (38): 1365-1414.

Refs: Gaynor & Muir Handbook of Vet Pain Mgt 2nd ed. pp. 57-9, 267-9, 439, Greene, Vet Anes and Pain Mgt Secrets pp. 323-30, 345-7 and the Merck Veterinary Manual online edition.

A painful response caused by damage to neural tissue

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Which of the following is commonly seen during Stage III, plane 4 of general anesthesia?

Miotic pupil	HIDE
Hyperemic mucous membranes	HIDE
Hypertension	HIDE
Abdominal respirations	HIDE

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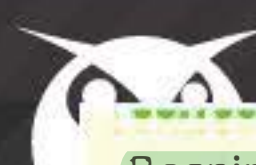
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Which of

Miotic p

Hyperer

Hyperte

Abdomin

Respiration becomes completely abdominal in Stage III, plane 4 and stops in Stage IV.

Abdominal respirations

Stage IV is an overdose of anesthesia -the patient will be very close to death.

Abdominal respiration means that only the diaphragm is working, the intercostal muscles of the chest are not. So the abdomen is seen moving in and out as the diaphragm contracts up and down, respectively.

The respiratory rate and tidal volume will be decreased, eyes will be central, and pupils very dilated. Blood pressure and heart rate eventually also decrease.

The inhalant anesthetic should be turned off immediately to decrease anesthetic depth, and the patient ventilated with 100% oxygen.

For more, see [Anesthetic Monitoring](#) and [Monitoring Anesthetic Depth](#) by Lyon Lee

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What part of an anesthetic circuit absorbs carbon dioxide?

Precision vaporizer unit	HIDE
Exhalation valve	HIDE
Flexible reservoir bag	HIDE
Soda lime canister	HIDE

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What part of the anesthetic circuit is responsible for removing CO2 from the expired gases?

Precision

Exhalation

Flexible

Soda lime

Correct:

A canister of soda lime granules in the anesthetic circuit absorbs carbon dioxide from exhaled anesthetic gasses.

Fresh absorbent crystals are white and can be crushed. But exhausted, saturated crystals become a distinct off-white color and are hard.

Most granules contain a pH-sensitive dye that becomes visible as the absorbent granules become saturated. (The color itself is not so important as the color changing).

A color change from white to purple or violet typically indicates that the CO2 scavenger granules have become saturated with CO2, but this color change does not always happen, and will dissipate after a few hours.

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Pentobarbital is the principal active ingredient in euthanasia solutions.

How does pentobarbital cause death?

Oxygen depletion	HIDE
Respiratory depression	HIDE
Cardiac arrest	HIDE
Severe, rapid drop in blood pressure	HIDE


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Correct

Respiratory depression

Pentobarbital, like all barbiturates, is associated most with **respiratory depression**.

When you give barbiturates to induce anesthesia, you give them **SLOWLY** to avoid respiratory depression, and you keep respiratory assistance (oxygen) on hand.

If you give a **euthanasia** dose of **pentobarb fast IV**, the animal stops breathing and simply collapses.

For **cardiac arrest**, think more of **potassium**.

Technically, you could argue that oxygen depletion is the cause of death by **pentobarb**, but it is the respiratory depression that gets you there.

Remember CATS are particularly sensitive to respiratory depression from barbiturates.

Severe, rapid drop in blood pressure

HIDE

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41

Pentobar

How doe

Oxygen

Respirat


Cardiac


Severe, rapid drop in blood pressure


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What will happen if you hit the oxygen flush button on an anesthetic machine?

Oxygen is flushed out of the system	HIDE
The patient will go to a deeper anesthetic plane	HIDE
Anesthetic gas concentration goes up in the breathing circuit	HIDE
The patient may start to wake up	HIDE

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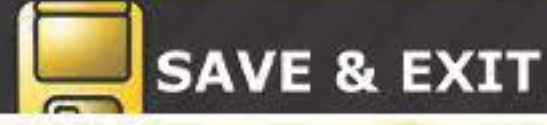

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Correct:

The patient may wake up.

The oxygen flush sends pure oxygen into the breathing circuit, **BYPASSING** the vaporizer.

What will

Anesthetic gas concentration **DECREASES**, and patients start to wake up.

Oxygen

The pati

Anesthe


The pati


Remember you should NOT hit the oxygen flush button **if the pop-off valve is closed**, or when using a non-rebreathing system, because you can deliver dangerously high airway pressure to the patient.


STRATEGY HINT: This is a kind of "frequency" question.

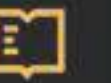
That is, you can see how the choice "wake up" and the "deeper anesthesia" choice


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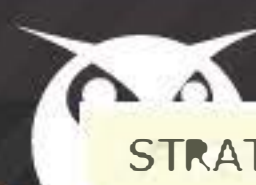

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What will

Oxygen

The pati

Anesthe

The pati

STRATEGY HINT: This is a kind of "frequency" question.

That is, you can see how the choice "wake up" and the "deeper anesthesia" choice are flip sides of the same possibility. (Kind of like being repeated, or increased frequency!).


Chances are that the correct choice will include the choice that is repeated the most often.

In this case, even if you have no idea what the right answer may be, simply narrowing down to the two answer choices will increase your chances of picking correctly to 50:50 !


Refs: McCurnin & Bassert, Clin Textbook for Vet Technicians, 8th ed. p. 1093, Fig 29-12.

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Which anesthetic drug can cause seizures if given in high doses?

Dissociative anesthetics	HIDE
Barbiturates	HIDE
Benzodiazepine tranquilizers	HIDE
Xylazine (Rompun)	HIDE

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Which are dissociative anesthetics?

Dissociative anesthetics

Barbiturates

Benzodiazepines

Xylazine


Correct:


Dissociative anesthetics, like ketamine or tiletamine, can cause seizures at high doses. In contrast all three of the other drugs listed here are sedatives.

Refs: Bassett and Thomas, McCurnin's Clinical Textbook for Veterinary Technicians, 8th ed. p. 1085, Plumb's Vet Drug Handbook, 7th ed. pp. 1317-9 and Tighe and Brown, Mosby's Comprehensive Review for Vet Techs, 2nd ed. pp. 301.

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What is xylazine primarily used for in bovine anesthesia protocols?

Sedation	HIDE
Pre-operative pain control and prevents hypoxemia	HIDE
Maintenance of anesthesia	HIDE
Induction of anesthesia	HIDE
Postoperative pain control	HIDE

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41

What is ...

Sedation

Pre-operative

Maintenance

Induction

Postoperative pain control

Correct: Sedation

Xylazine (and its more potent cousin, detomidine) are used as sedatives in cattle. Remember the cow dose is about 10-20 times LESS than dogs or horses.

Bloat and hypoxemia are a concern when you use these drugs in cattle.


Xylazine is reversed with yohimbine, atipamezole, or tolazoline.

Refs: Plumb's Veterinary Drug Handbook, 7th ed. pp. 1397-1402 and Merck Veterinary Manual online edition


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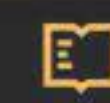
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Which of the following drugs is **contraindicated** for use in a dog or cat **sedated with dexmedetomidine**?

Atropine	HIDE
Atipamezole	HIDE
Midazolam	HIDE
Isoflurane	HIDE
Butorphanol	HIDE

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41

Which of the following is contraindicated when dexmedetomidine is used in dogs and cats?

Atropine

Atipamezole

Midazolam

Isoflurane

Correct:
Atropine is contraindicated when dexmedetomidine is used in dogs and cats.
Atropine blocks parasympathetic tone in the heart, which results tachycardia.
Alpha-2 agonists (such as dexmedetomidine) cause vasoconstriction and high blood pressure. The heart rate slows in response to the high blood pressure.
This is called a "reflex bradycardia" or a "baroreceptor" response as the cardiovascular system strives to keep blood pressure within a normal range. It is mediated via the parasympathetic input via the vagal nerve. It protects the heart from the increased work that would be required if it were to beat fast against high vascular tone.

Atropine

Atipamezole

Midazolam

Isoflurane

Butorphanol

HIDE

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Atropine	HIDE
Atipamezole	HIDE

Midazolam

Isoflurane

Butorphanol

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mediated via the parasympathetic input via the vagal nerve. It protects the heart from the increased work that would be required if it were to beat fast against high vascular tone.

When the baroreceptor response is blocked, the heart rate cannot slow down. This can be dangerous as the increased myocardial work requires greater oxygen consumption.

The incidence of arrhythmias from alpha-2 agonists in dogs is also greater when atropine is also given.

Refs: Journal of the AVMA, 2011 Jul 1;239(1):81-9, Veterinary Record, 2008 Jun 28;162(26):852-6, and the Merck Vet Manual online.

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What type of anesthetic breathing circuit is a Bain system run at a high flow rate (200-300 ml/kg/min)?

Partial rebreathing	HIDE
Nonrebreathing	HIDE
Closed system	HIDE
Semi-closed system	HIDE

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What type of system is a Bain circuit?
ml/kg/min

Partial rebreathing

Nonrebreathing

Closed system

Semi-closed system

Correct: Nonrebreathing

A Bain anesthetic circuit run at a high flow rate of 200-300 ml/kg/min will not allow rebreathing of exhaled gasses.

Remember that a Bain system is like a tube within a tube. New oxygen and anesthetic gas is inhaled down the inner tube, and exhaled gas exits through the outer tube.

At flow rates of 130-200 ml/kg/min or less the Bain functions as a partial rebreathing system, and the animal rebreathes some of the exhaled gasses

Semi-closed and partial rebreathing systems are the same thing.

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What type of flow rates are used in a closed anesthetic rebreathing system?

Partial rebreathing

Nonrebreathing

Closed system

Semi-closed system

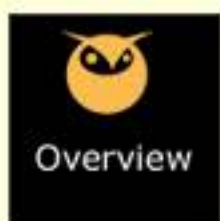
They run at intermediate flow rates where fresh gas is delivered in excess of metabolic consumption, from about 10 ml/kg/min (large animals) or 30 ml/kg/min (small animals).

A closed anesthetic rebreathing system only provides enough fresh gas flow to meet an animal's metabolic needs, about 5-10 ml/kg/min (depending on animal size. Flow is lower for larger animals and higher for smaller animals).

Refs: Bassert and Thomas, McCurnin's Clinical Textbook for Veterinary Technicians, 8th ed. pp. 1094-5 and Tighe & Brown, Mosby's Comprehensive Review for Vet Techs, 2nd ed. pp. 308-9

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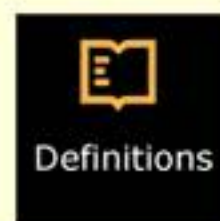
Overview



Mark this Question



Lab Values



Definitions



Report a Problem

**zukureview**

SAVE & EXIT

PREV

NEXT

41	✓	42	✗	43	✓	44	✓	45	✓	46	✓	47	✓	48	✗	49	✓	50
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Which of the following correctly describes pathologic pain?

Increased response to a stimulus that normally produces pain	HIDE
Stimuli that are not normally painful produce a pain response	HIDE
A response beyond that needed to protect one from injury	HIDE
Decreased response to stimuli that usually cause pain	HIDE
A protective response to an actual or potentially damaging insult	HIDE

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LEAVE BLANK

Overview

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 PREV

41 

Which of the following is a response that is heightened beyond that needed to protect the patient from injury?

Increase response to stimuli

A response to stimuli that is not normally painful

Decreased response to stimuli

Correct:

Pathologic **pain** is a response that is heightened beyond that needed to protect the patient from injury.

It develops in response to tissue damage that occurs with trauma or surgery. Both peripheral and central sensitization occur, amplifying the pain response.

In contrast, **physiologic pain** is an acute, protective response to an actual or potentially damaging insult, while **hyperalgesia** is an increased response to a stimulus that normally produces pain.

Allodynia is present when stimuli that are NOT normally painful produce a pain response. **Decreased response** to stimuli that usually cause pain is **hypoalgesia**.

A protective response to an actual or potentially damaging insult HIDE

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Overview


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Numerous pauses are heard on the Doppler of a dog anesthetized with isoflurane. The veterinary technician monitoring the dog is having trouble evaluating the heart rhythm from this electrocardiogram.

Which of the following is the main problem?

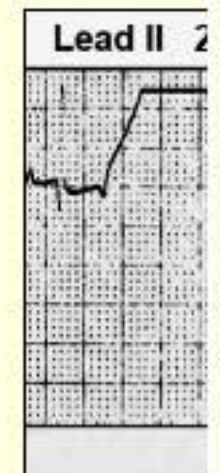


- | | |
|---|------|
| The wrong lead set up was used to record the ECG | HIDE |
| Respiratory motion has distorted the baseline | HIDE |
| The paper speed is too slow | HIDE |
| This patient must be very large, the waveforms don't fit on the paper | HIDE |

51

Numerous
veterinary
this electro

Which of



Correct:

Respiratory motion has distorted the recording, causing the undulating wave-like baseline seen.

To correct this, move the lead attachments further away from the chest, or select a different lead (Lead I or III) to see if this artifact remains.

When the recording was corrected, second degree AV block was discovered, as seen in this ECG.

This is a good example of one advantage of using a Doppler blood pressure monitor – since cardiac pulsations are continuously audible, it is obvious when an arrhythmia occurs.

Click link for excellent website - [Interpretation of ECGs](#) from UPenn.

The wrong lead set up was used to record the ECG	
Respiratory motion has distorted the baseline	HIDE
The paper speed is too slow	HIDE
This patient must be very large, the waveforms don't fit on the paper	HIDE