

**Equine Stress and
Fear:
What are the
answers to safer
rescues?**

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Fearful and Intractable large animals

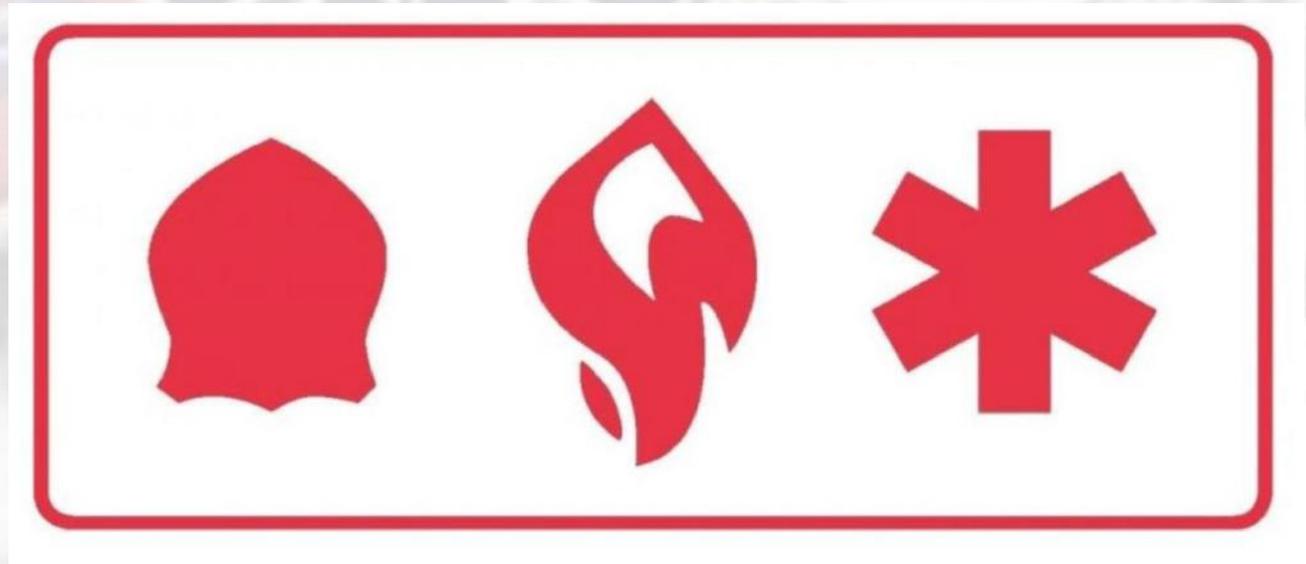
Learning Objectives

Participants will learn:

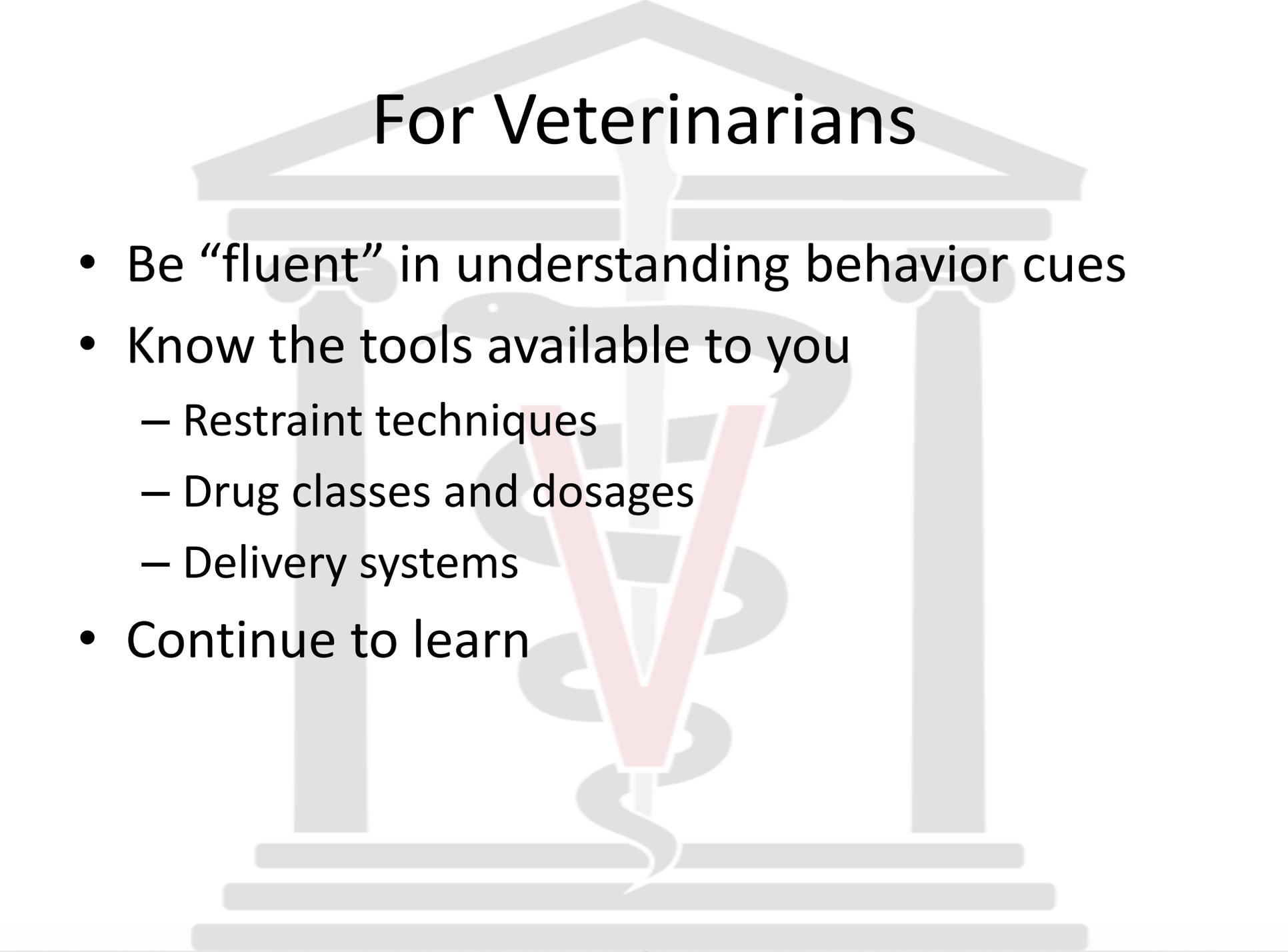
- How to adjust sedation and anesthesia doses to fit patient's temperament and proposed procedure
- Indications for remote chemical capture
- Equipment for remote delivery of drugs to horses and cattle
- Drug combinations used for sedation
- New research on novel ways to reduce stress and fear in horses

For First Responders

- Recognition that you are working with a different species
- Knowledge of basic equine behavior
- Have expertise available



For Veterinarians



- Be “fluent” in understanding behavior cues
- Know the tools available to you
 - Restraint techniques
 - Drug classes and dosages
 - Delivery systems
- Continue to learn

Horse Owners:



Cindy: Train your horses!

Breed Differences

A dark horse and a small brown and white pony standing in a grassy field. The dark horse is on the right, and the pony is on the left. The background is a blurred green field with a white fence and trees.

- Thoroughbred
- Draft horse
- Donkeys
- Mules

Individuality beyond breed!

- Level of training
- Accustomed environment
- Previous experiences



Criteria When Considering Chemical Restraint

Pros

- Reduction of anxiety
- Reduction of pain
- Make animal more tractable
- Allow recumbent transport
- Allow aerial transport
- Personnel safety
- Scene safety

Cons

- Weak animals become weaker, compromising ability to stand
- Recovery
 - Skill required
 - Safe facility required
- Falling
 - Water
 - Entrapment
 - Vertical drop
- Physiologic compromise
- Personnel safety – false security!

Patient Variables in Chemical Restraint

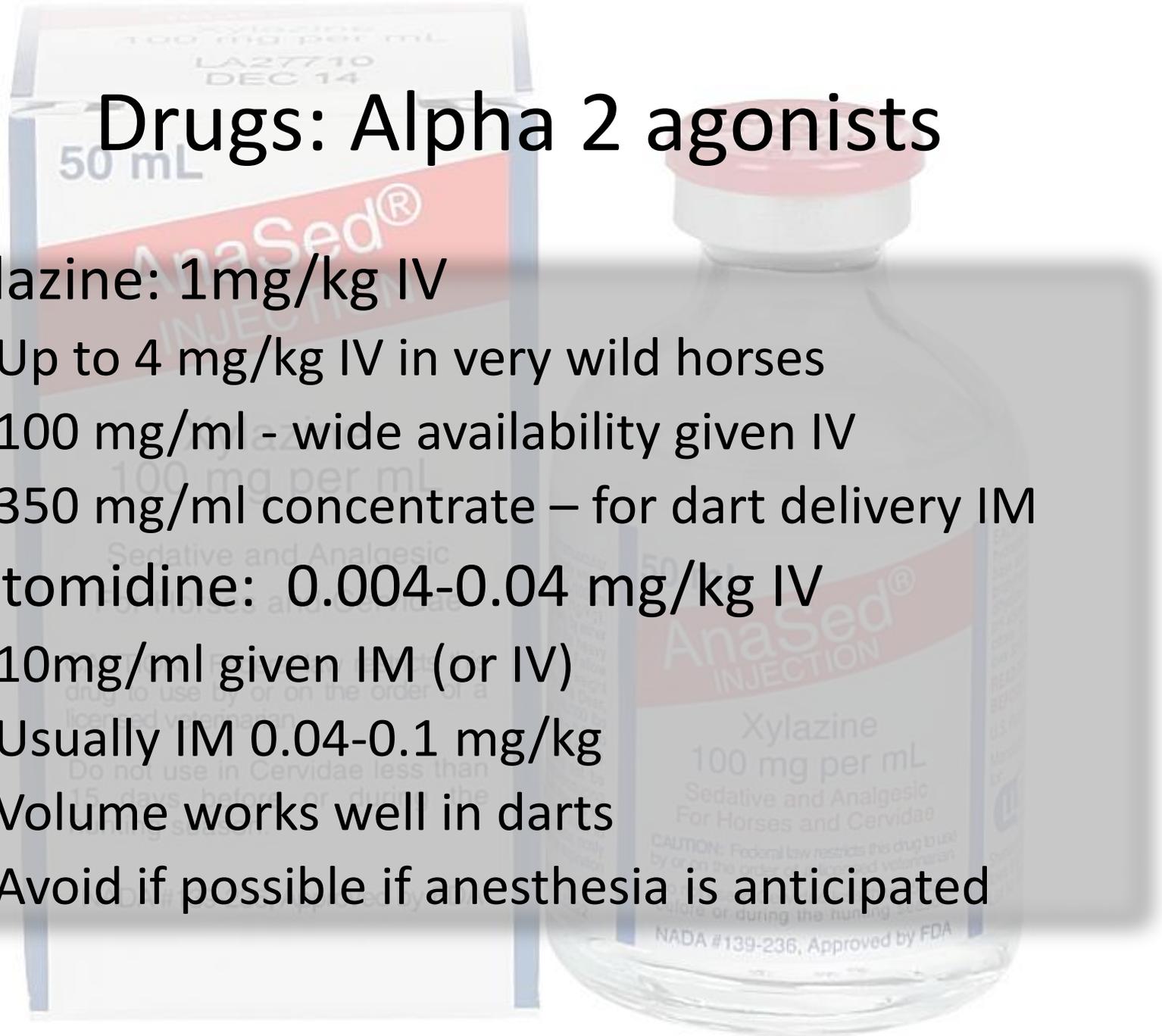
- Cardiovascular stability
- Hydration status
- Hypo / hyperthermia
- Temperament / breed/ species
- Age
- Degree of prior handling of the horse
- Terrain, altitude, etc
- Anticipated body position and length of transport
- Immediate pre-rescue history
- Need for other stimulating procedures

Sedation Choices

- Alpha 2 agonists
 - ‘Rapid’ profound sedation
 - Slows heart rate
- Acepromazine
 - Milder sedation and longer onset
 - Lowers blood pressure

Drugs: Alpha 2 agonists

- Xylazine: 1mg/kg IV
 - Up to 4 mg/kg IV in very wild horses
 - 100 mg/ml - wide availability given IV
 - 350 mg/ml concentrate – for dart delivery IM
- Detomidine: 0.004-0.04 mg/kg IV
 - 10mg/ml given IM (or IV)
 - Usually IM 0.04-0.1 mg/kg
 - Volume works well in darts
 - Avoid if possible if anesthesia is anticipated



Romifidine

- 0.1 mg/kg IV
- Reports of improved standing sedation when given with detomidine in dentistry
- Improved recovery after inhalant anesthesia
- Used with Acepromazine, butorphanol, and Telazol for field anesthesia in Europe

Drugs: Butorphanol

- Synthetic opioid agonist-antagonist
- 0.02-0.04 mgs/kg IV – with Alpha 2
- Amplifies sedative effects of Alpha 2' s
 - Lip and head fasciculations
 - Makes some horses want to walk forward
- Concentrations:
 - 10mg/ml standard
 - 30 mg/ml and 50 mg/ml for IM darts

Sedation precautions

- Wait until head is below withers before
 - Stimulating the horse
 - Induction of anesthesia
- Be prepared for sudden arousal
- Use same handling precautions as with an un-sedated horse!!
- Sedation will NOT allow unskilled horsemen to deal with intractable patients!



Reversal Agents

- Tolazine

- 100 mg/ml
- 500kg horse = 20mls
- Give over 30 seconds
- Onset in 5 minutes
- Not recommended for use in horses exhibiting signs of stress, hypovolemia, shock.
- Adverse effects:
 - Transient tachycardia
 - Peripheral vasodilation
 - Hyperthermia
 - Lip flipping and licking
 - Muscle fasciculation
 - Death

- Yohimbine

- 2mg/ml
- 500kg horse = 19mls
- Give over 30 seconds
- Onset in 3 minutes
- Adverse effects:
 - Apprehension
 - CNS excitement
 - Muscle tremors
 - Increased respiratory rates
 - Death

Drug delivery for sedation

- Venipuncture with needle
 - Easy in the horse
 - Takes some experience in
 - Anxious horse
 - Recumbent horse
- IV Catheter placement
- Intramuscular injection
 - Easier in intractable horse
 - Less useful for anesthesia
- Remote delivery of intramuscular injections
 - Not as effective in horses as in cattle
 - Requires extra technical skill and equipment
- Oral
 - Detomidine paste
 - Acepromazine

Opioids: Etorphine and Carfentanil

- Extremely potent, even when given IM
- Used with alpha 2's in horses
- Reversible
- Potential for toxicity in animals
- Very dangerous to humans
- Controlled Schedule II: Require veterinarian with a special license
- Used primarily in zoo setting

COLUMBUS FIRE

PARAMEDICS

7

BAM

- BAM –
 - Butorphanol -27.3 mg/ml
 - Azaparone – 9.1 mg/ml
 - Medetomidine – 10.1 mg/ml
 - Atipamazole/Naltrexone reversal
- Recommend add 200 mgs ketamine for anesthesia
- Recumbency in 18 – 22 min.
- Reverse IM after 45 min. – 1 hr. (Atipamezole and Naltrexone)



CRI For Sedation (mixed with sterile IV solution - saline)

- Detomidine 10 mg/ml (IV)
 - 10 micro g/kg bolus
 - followed by 0.5 micro g/kg/min for 15 min
 - then 0.3 micro g/kg/min for 15 min
 - then 0.1 micro g/kg/ min.
- +/- Butorphanol 10 mg/ml:
10–15 micro g/kg/min



DETOMIDINE SEDATION CRI

Add Detomidine to 250 ml bag of NaCl - Run through a **15 drop per ml** admin set

lb.	kg	µg Initial Bolus	Detomidine Initial Bolus 10 µg/kg		Detomidine CRI		Time frame	Volume Desired	Rate	Volume Delivered
			mg	ml 10 mg/ml	For use over one hour					
					ml	mg				
100	45	450	0.45	0.045	.067	.675	Minutes 1 to 15	125 ml	2 drops per second	120 ml
200	90	900	0.9	0.09	0.13	1.35				
300	135	1350	1.3	0.13	0.20	2.02				
400	180	1800	1.8	0.18	0.27	2.7	Minutes 16 to 30	75 ml	1 drop per second	60 ml
500	225	2250	2.2	0.22	0.34	3.4				
600	270	2700	2.7	0.27	0.40	4.0				
700	315	3150	3.1	0.32	0.47	4.7				
800	360	3600	3.6	0.36	0.54	5.4	CRI Rate Minutes 31 to 60	50 mls	1 drop every 2 seconds second	60 mls
900	405	4050	4.0	0.40	0.61	6.1				
1000	450	4500	4.5	0.45	0.67	6.7				
1100	495	4950	4.9	0.50	0.74	7.4				
1200	540	5400	5.4	0.54	0.81	8.1				

Rate must be adjusted as needed for each patient

Remote Chemical Capture

- Pros

- Ability to tranquilize large animals on the loose
- Safe and inexpensive when used properly

- Cons

- Immobilization is difficult, especially in equids
- Requires skilled animal handling
- Learning curve
 - Equipment and drugs
 - Handling of tranquilized animals

Chemical Capture Options

- Syringe Pole
- Dart Gun
- Drugs
 - Alpha 2 agonists
 - Xylazine (350 mg/ml)
 - Detomidine
 - Dexmedetomidine
 - Dissociative agents
 - Telazol
 - Ketamine / Midazolam
 - Synthetic opioids
 - Etorphine
 - Carfenanil

Pole Syringes

- In effect, it is just a syringe with a long plunger.
- They require much closer proximity to the animal and an actual “touch”
- They have few ‘moving parts’ and are easy to use



Darts that can be projected



Projectors



Remotely delivered drugs can help IF:

- Personnel are trained
- Personnel practice regularly
- Personnel are skilled in the handling of livestock
- Animals are not running (flight response is triggered)
- Animals can't move into dangerous areas in 5-10 minutes
- Animals can be corralled after sedation/immobilization
- The team HAS a plan, WITH contingencies

Keep them QUIET!

- Dart with other horses
- Time to achieve sedation
- Approached slowly
- Approach from trained horse



Remote Drug Delivery in Horses

- Less sensitive to Alpha 2's
- Good immobilization drugs lacking
 - Ideally given IV
 - Require drug concentration or opioids
- Recovery from anesthesia can be catastrophic
- Once flight response initiated drugs do not work well

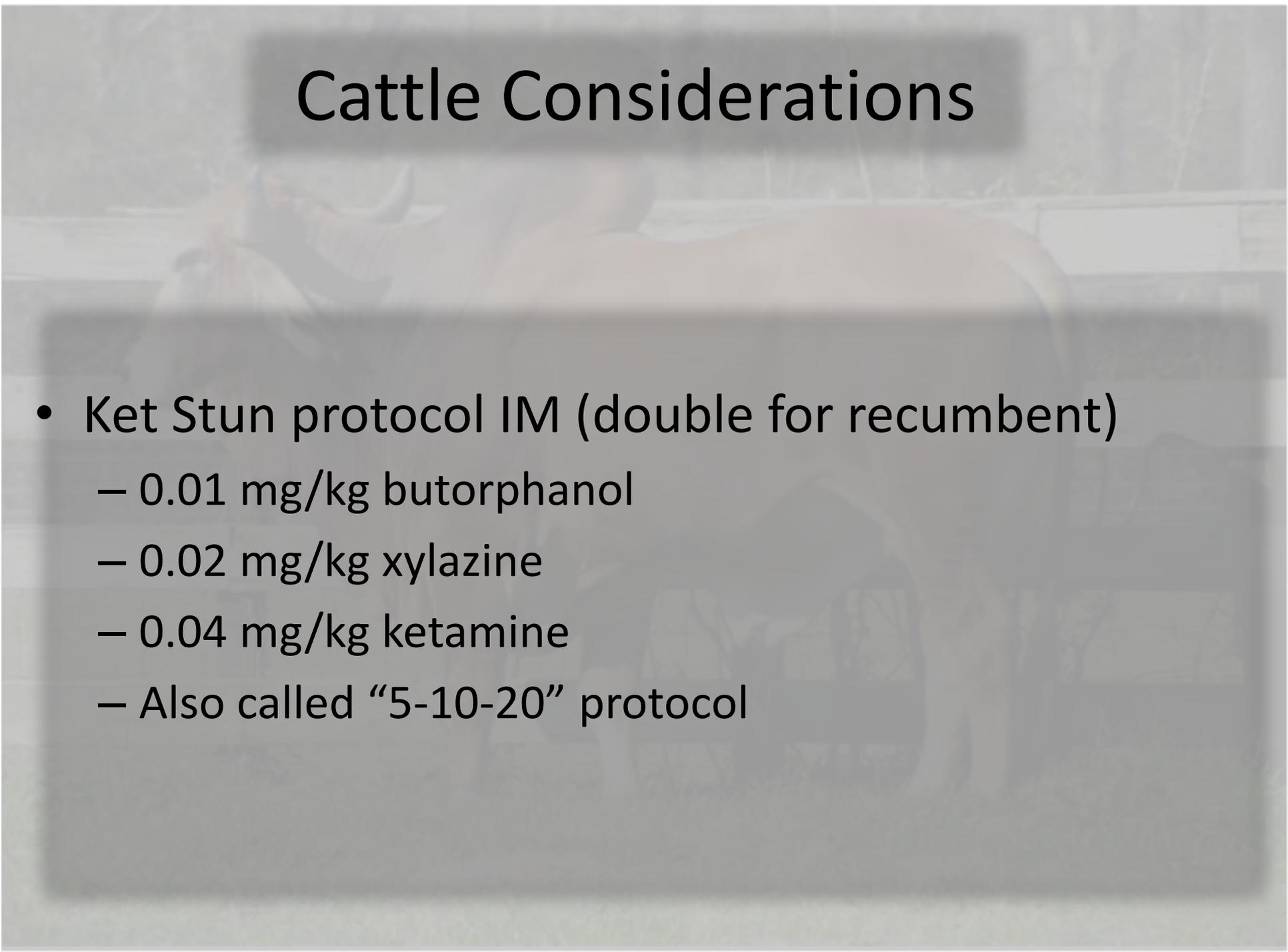


Cattle

- Sensitive to Alfa 2 sedatives
 - Available
 - Safe
 - Reversible
- More stoic than horses
- Recover well
- Bloat and regurgitation are serious concerns

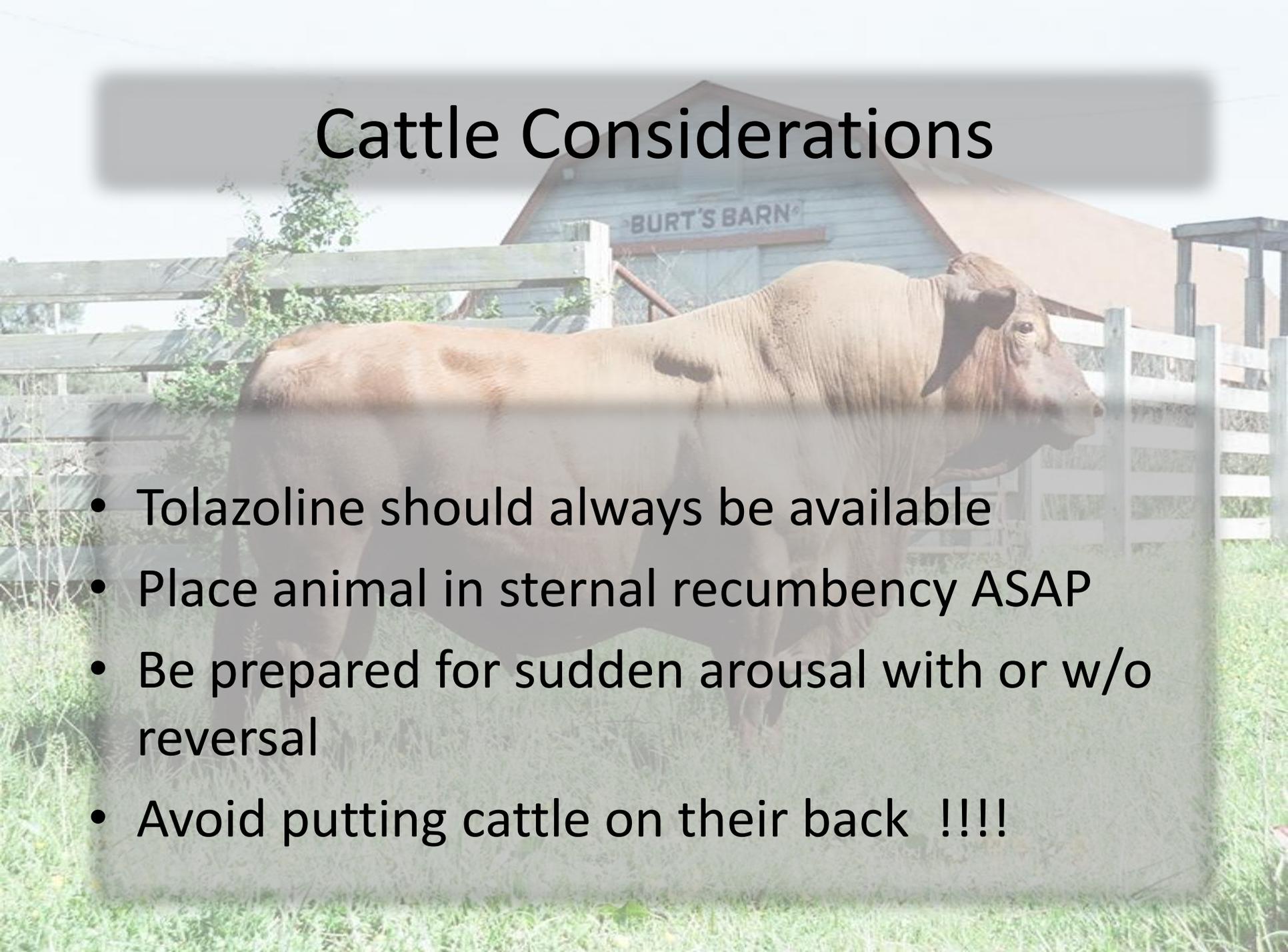


Cattle Considerations



- Ket Stun protocol IM (double for recumbent)
 - 0.01 mg/kg butorphanol
 - 0.02 mg/kg xylazine
 - 0.04 mg/kg ketamine
 - Also called “5-10-20” protocol

Cattle Considerations

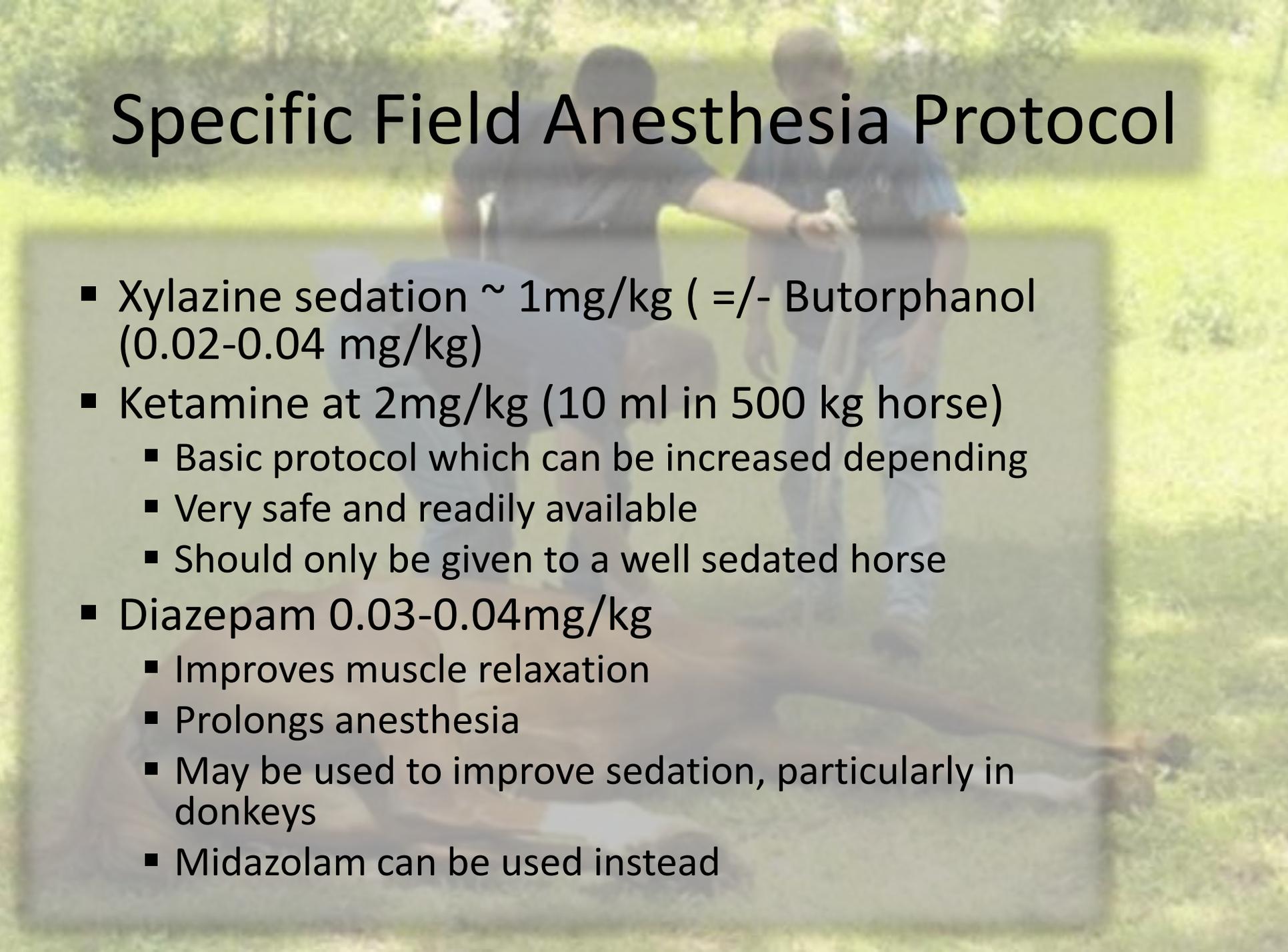
A brown cow is standing in a grassy field, facing right. In the background, there is a wooden fence and a barn with the words "BURT'S BARN" written on its side. The scene is outdoors with trees and a clear sky.

- Tolazoline should always be available
- Place animal in sternal recumbency ASAP
- Be prepared for sudden arousal with or w/o reversal
- Avoid putting cattle on their back !!!!

Deciding on sedation vs. anesthesia

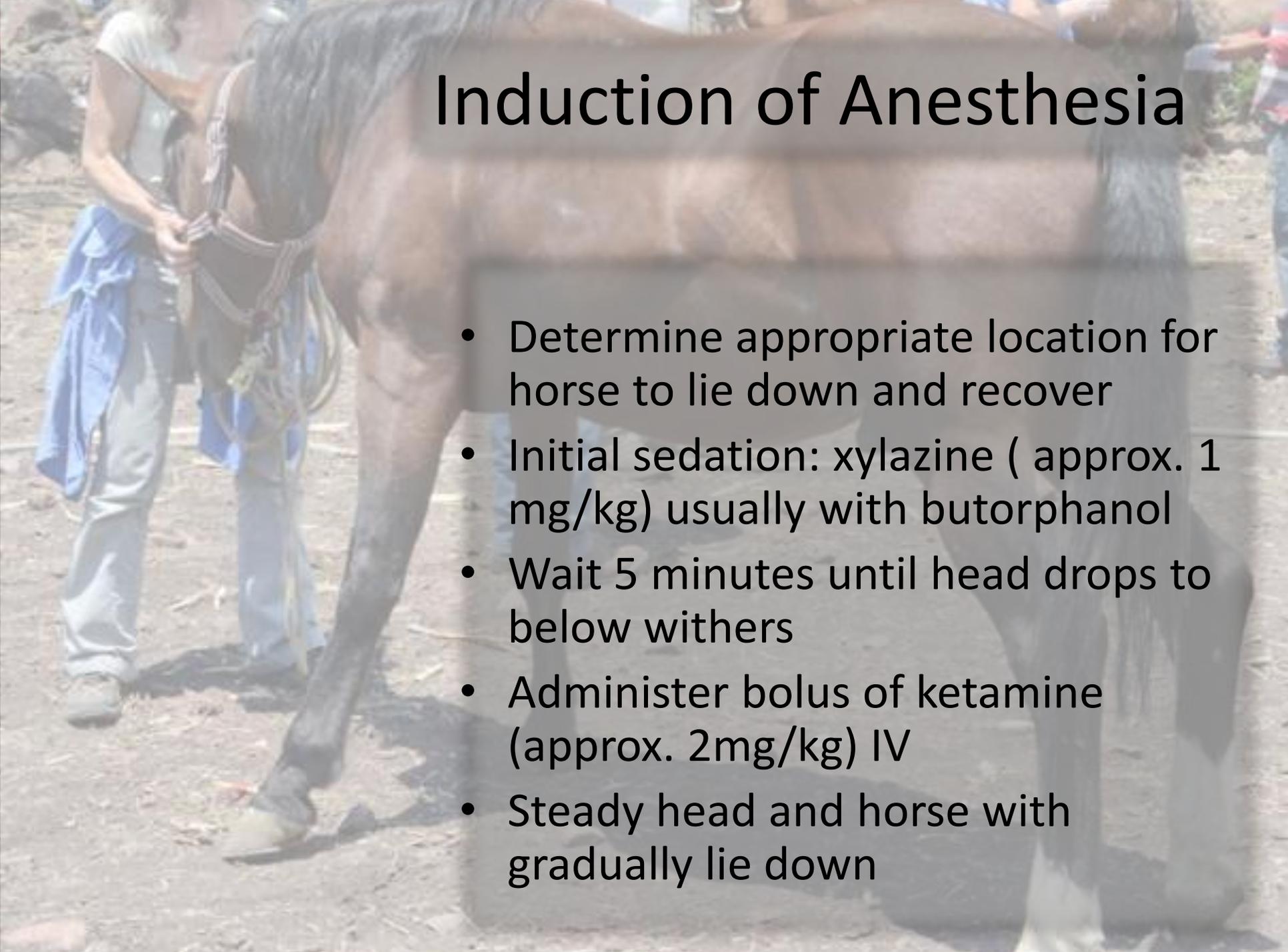
- Decide early
 - Do not allow increasing levels of anxiety
 - Look at all options, choosing the one that requires the least drug
- Have a plan
 - Animal's need to remain standing?
 - Animal's need to ambulate?
 - IF anesthesia: safe recovery plan?

Specific Field Anesthesia Protocol



- Xylazine sedation ~ 1mg/kg (=/- Butorphanol (0.02-0.04 mg/kg)
- Ketamine at 2mg/kg (10 ml in 500 kg horse)
 - Basic protocol which can be increased depending
 - Very safe and readily available
 - Should only be given to a well sedated horse
- Diazepam 0.03-0.04mg/kg
 - Improves muscle relaxation
 - Prolongs anesthesia
 - May be used to improve sedation, particularly in donkeys
 - Midazolam can be used instead

Induction of Anesthesia

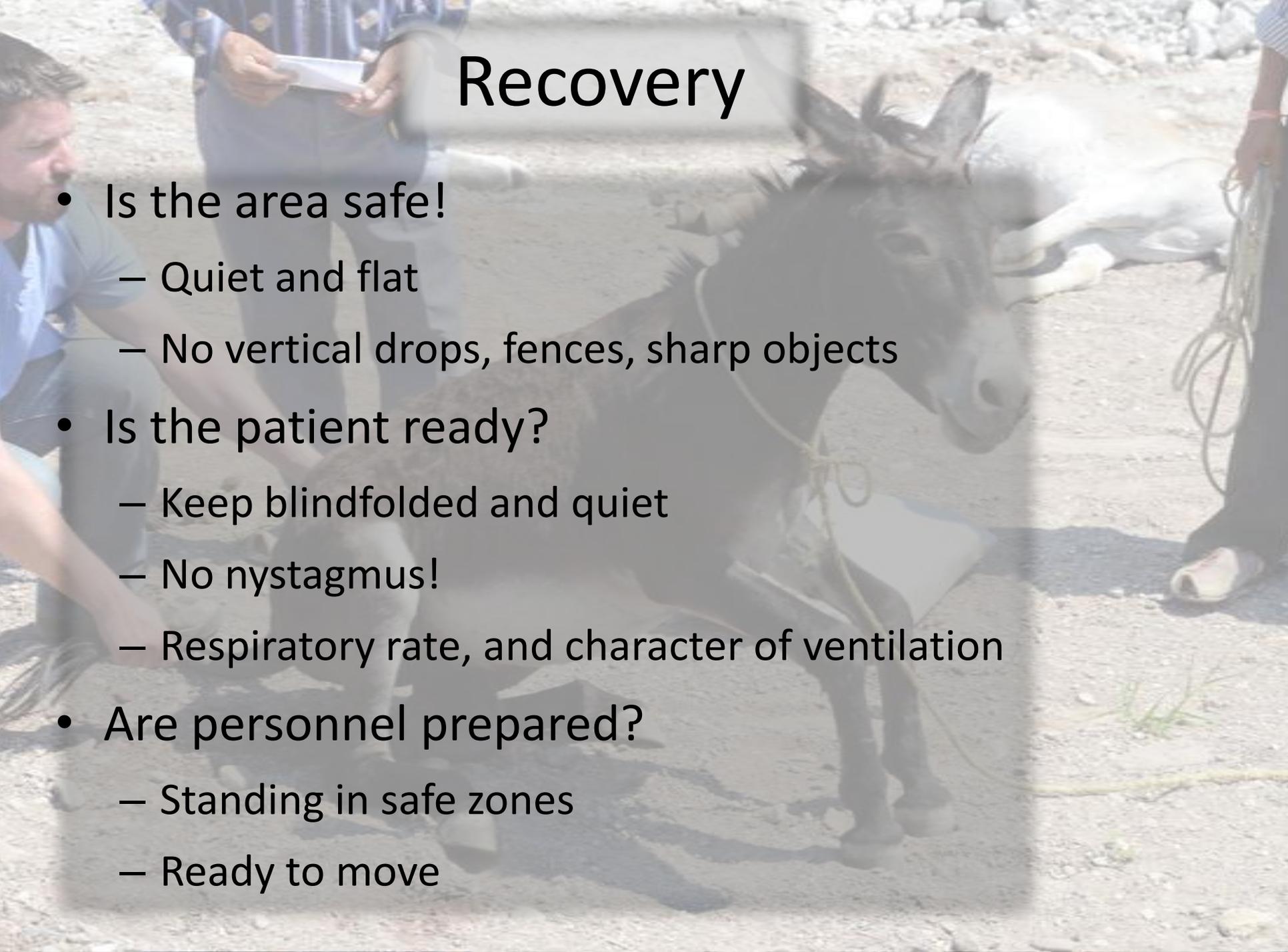
A person wearing blue scrubs and a white shirt is leading a dark-colored horse. The horse is wearing a halter and a lead rope. The background is a dirt area with some people and structures in the distance.

- Determine appropriate location for horse to lie down and recover
- Initial sedation: xylazine (approx. 1 mg/kg) usually with butorphanol
- Wait 5 minutes until head drops to below withers
- Administer bolus of ketamine (approx. 2mg/kg) IV
- Steady head and horse with gradually lie down

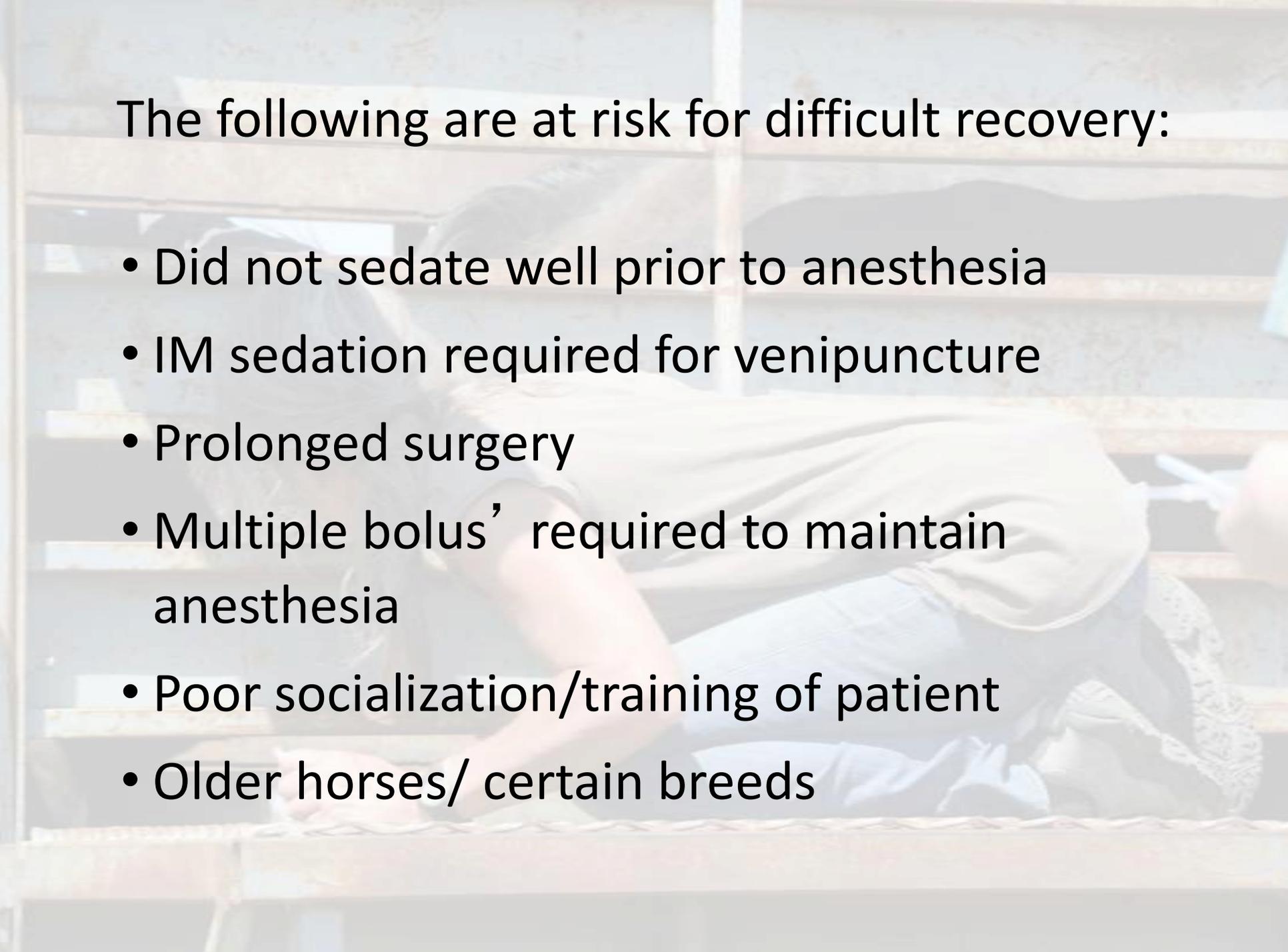
Anesthetic maintenance

- Most horses will be able to have procedures performed for 20-40 min with the induction dose
 - Xylazine/Ketamine/Valium anesthesia has been successfully used for 2 hours
- Longer anesthesia – catheter and oxygen by nasal or oral tracheal tube if over 40 minutes
- Anesthetist
 - Monitors level of anesthesia
 - Gives small bolus' of 1-3 mls of xylazine mixed with 2-5 mls of ketamine
 - Or “double drip”

Recovery



- Is the area safe!
 - Quiet and flat
 - No vertical drops, fences, sharp objects
- Is the patient ready?
 - Keep blindfolded and quiet
 - No nystagmus!
 - Respiratory rate, and character of ventilation
- Are personnel prepared?
 - Standing in safe zones
 - Ready to move



The following are at risk for difficult recovery:

- Did not sedate well prior to anesthesia
- IM sedation required for venipuncture
- Prolonged surgery
- Multiple bolus' required to maintain anesthesia
- Poor socialization/training of patient
- Older horses/ certain breeds

Handling the Difficult Recovery

- Keep horse quiet and blindfolded
- Hold horse down by head
- Administer 0.5-1 mls (50-100 mgs) of xylazine after surgery
- Do not reverse Alpha 2 unless:
 - 1 hr. post last ketamine
 - Slow IV reversal if cardiovascular deterioration

ADJUSTING PREMED TO FIT PATIENT AND SITUATION

Premed	Standard Dose	Very Quiet Patient	No Butorphanol Available	Slightly Excitable	Moderately Excitable	Very Excited or Excitable
Xylazine Adjustment		Decrease by up to 50%	Increase 10%	Increase 20%-25%	Increase 50%	Increase 80% - 100%
Xylazine Dose	1 mg/kg	0.75 mg/kg	1.1 mg/kg	1.2 mg/kg	1.5 mg/kg	1.8 to 2 mg/kg
Butorphanol	0.02 mg/kg	0.02 mg/kg	-----	0.02 mg/kg	0.03-0.04 mg/kg	0.04 mg/kg
Detomidine	0.02-0.04 mg/kg IM	-----	-----	----- ---	-----	0.04-0.1 mg/kg IM w/ dart if necessary

Double Drip

- Mix for 500 kg horse
 - 10 mls xylazine (500 mg)
 - 35 mls ketamine (3.5 grams)
 - 250 ml bag of NaCl or LRS.
- Run at 1 drop per second through a 15 dr/ml admin set
- Adjust rate for patient

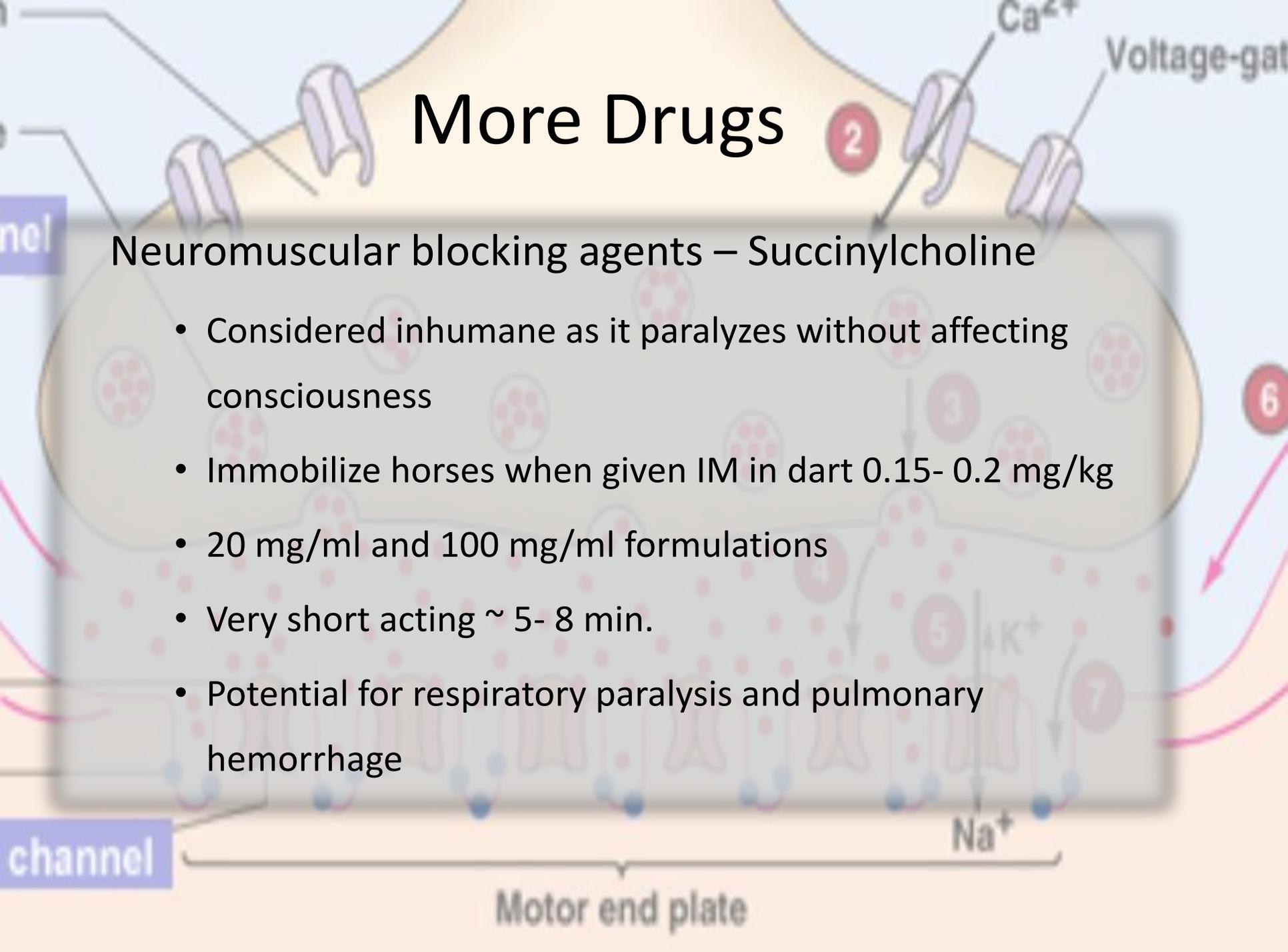
Double Drip Mixing (in 250 mls Saline)

Weight in kgs	Weight in lbs	XYLAZINE mls 2.1 mg/kg/hr	KETAMINE mls 7.2 mg/kg/hr
50	110	1	3.6
75	165	1.6	5.4
100	220	2.1	7.2
150	330	3.5	10.8
200	440	4.2	14.4
250	550	5.2	18.0
300	660	6.3	21.6
400	880	8.4	28.8
450	990	9.5	33.0
500	1100	10.5	36.0
550	1210	11.5	40.0
600	1320	12.6	43.2
650	1430	13.7	47.0

More Drugs

Neuromuscular blocking agents – Succinylcholine

- Considered inhumane as it paralyzes without affecting consciousness
- Immobilize horses when given IM in dart 0.15- 0.2 mg/kg
- 20 mg/ml and 100 mg/ml formulations
- Very short acting ~ 5- 8 min.
- Potential for respiratory paralysis and pulmonary hemorrhage



Modification of Fear and Anxiety

- Reserpine – long acting blockage of several neurotransmitters
- Benzodiazepines
- Selective Serotonin reuptake inhibitors (Prozac)
- Beta Blockers

Propranolol

- Stage fright since 1976
- Surgeons
- Archery and shooting
- Musicians
- Snooker



Propranolol

- Competitive blockade of catecholamines on adrenergic beta receptors
 - Adrenaline (epinephrine)
 - Noradrenaline (norepinephrine)
- Sympathetic nervous system: Fight or Flight
- Blockade inhibits the effect of stress hormones
- Used to control hypertension

Epinephrine

- β_1
 - Cardiac muscle – increase rate and contraction
 - Kidney – renin release (\uparrow blood pressure)
- β_2
 - Smooth muscle relaxation
 - Skeletal muscle tremor
 - Energy generation in liver and muscle
- β_3 – Fat breakdown in adipose tissue

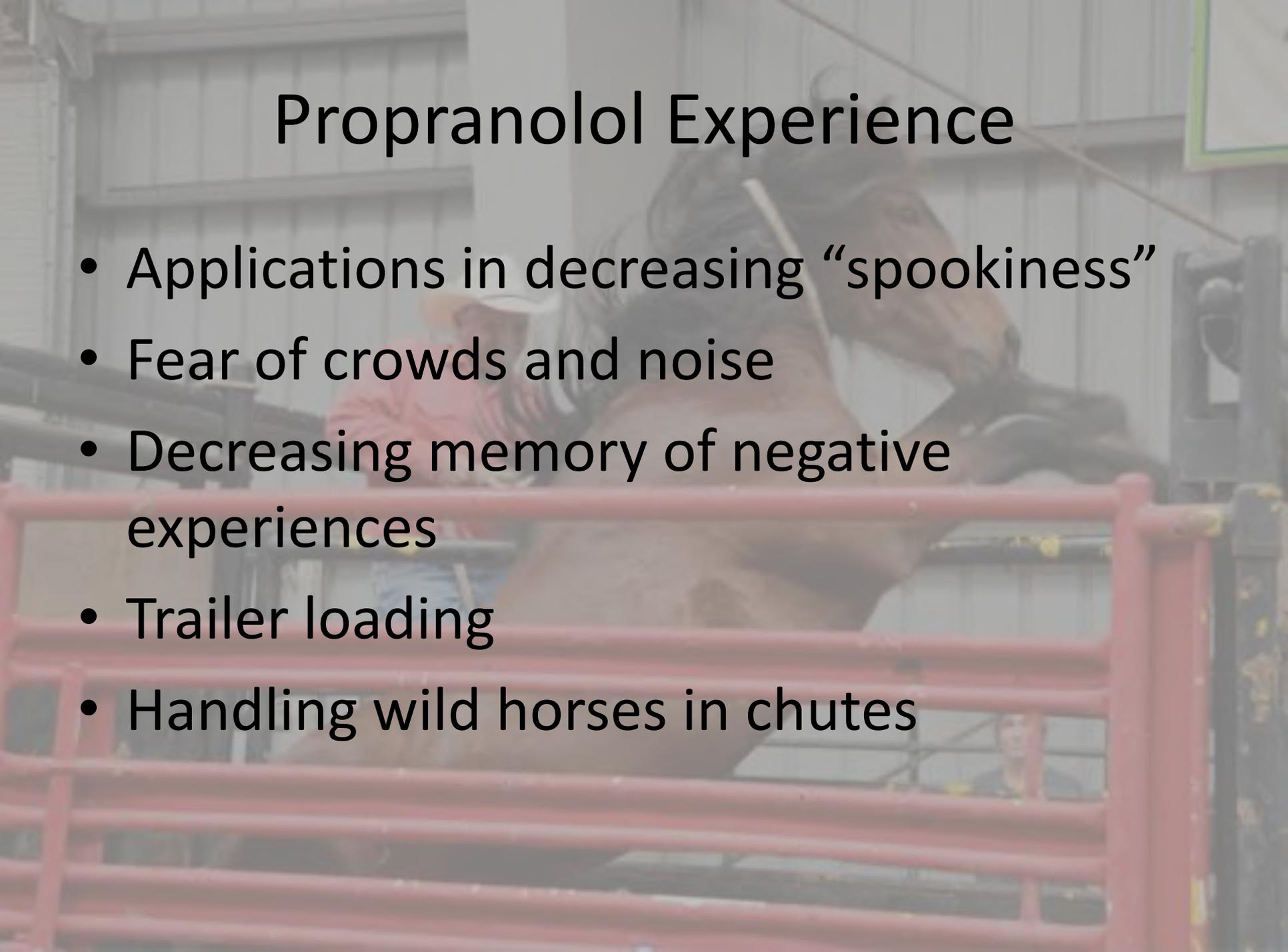


Beta receptors in CNS

- Lateral Nucleus of amygdala
- Beta 1 and 2
- Fear and anxiety
- Fear memory
 - Formation
 - Acquisition



Propranolol Experience

A person wearing a red shirt and a white cowboy hat is leading a brown horse through a red metal chute in a stable. The horse is moving forward, and the person is holding a lead rope. The background shows the interior of a stable with wooden walls and a window.

- Applications in decreasing “spookiness”
- Fear of crowds and noise
- Decreasing memory of negative experiences
- Trailer loading
- Handling wild horses in chutes

Research

- Meta analysis of research (Steenen, van Wijk et al, J. Psychopharmacology, 30(2), 2016).
 - Available human data do not support use of propranolol for anxiolysis
 - Separate study showed positive effect in fear of dentistry
- Pharmacokinetics of Propranolol and Romifidine (Cenani, Brosnan et al, Vet Anesthesia and Analgesia 2016)
 - 1 mg/kg IV w/o cardiovascular effects
 - Augmentation of Alpha 2 sedation
 - No effect on response to stimuli when used alone

Research

- Trailer loading model in young Thoroughbreds
- Crossover study
- Intravenous formulation
 - Low dose 0.15 mg/kg
 - High dose 0.30 mg/kg
 - Placebo
- Median score slightly higher for higher dose P
- No apparent effect on actual trailer loading
- Analysis of cortisol levels and video pending



Sedation by cowboy: questions?