Determining Insensibility and Unconsciousness in Cattle, Pigs, and Sheep

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Humane Slaughter Act

All animals are rendered insensible to pain by a single blow or gunshot or an electrical chemical, or other means that are rapid and effective.
Three Stages

- Definitely conscious (sensible to pain)
- Transition Gray Zone
- Unconscious and brain dead (Terlouw et al., 2016)
All Methods of Stunning
Definitely Conscious – Also Applies to Religious Slaughter

• Remains standing
• Head or body righting reflex on the rail
• Voluntary vocalization
• Spontaneous blinking (do not confuse with nystagmus)
• Eye pursuit to moving object
• Response to threat (menace) test - No touching

(Terlouw, et al., 2016)

If any one of these signs is present, the animal is conscious.

RESTUN IMMEDIATELY
All Methods of Stunning
Definitely Unconscious – Also Applies to Religious Slaughter

- Absence of corneal reflex to touch
- Absence of eyelash reflex to touch
- Absence of rhythmic breathing (do not confuse with gasping)
- Absence of response to thread (menace) test – No touching

(Terlouw et al., 2016; Verhoeven, et al., 2016)

ALL of the above signs must be absent
All Methods of Stunning Unconscious but Beginning to Transition Back to Consciousness

Situations where a second shot application of the electric stunner prevents return to sensibility.

- Weak corneal reflex
- Eyelash reflex
- Rhythmic breathing

All indicators of definite consciousness must be absent
Gray Zone

✓ Transition Zone between definitely conscious and definitely unconscious and brain dead

✓ An immediate 2\textsuperscript{nd} captive bolt or gunshot prevents return to sensibility and would prevent Humane Slaughter Act violation
All Methods of Stunning

✓ Before invasive dressing procedures start after bleeding
✓ All indicators of definite consciousness and definitely unconscious or brain dead must be absent
✓ No corneal reflex
Confirmation of Brain Dead

- In cattle shot with captive bolt or gunshot, use corneal reflex. Touch eyeball with finger.
- In pigs and sheep, do NOT poke eyes with a finger because it can get forced shut and stuck with mucous. When it pops open, it may look like a blink.
- Use a small blunt object, such as a pencil eraser to touch the cornea.
- Conflict between scientific recommendations and commercial correlation
- Be extremely careful with testing corneal reflexes in pigs. It is easy to get confused.

Grandin, 2001
Sensible bovine with righting reflex

(Photo not from U.S.)
Righting Reflex in a Fully Sensible Pig

Photo not from U.S.
Order of Events
Return to Sensibility

Transition Zone
1. Corneal reflex – Brain stem reflex
2. Rhythmic breathing

Conscious
3. Spontaneous natural blinking like live animal
4. Menace (threat) reflex – wave hand near eye
5. Response to painful stimulus
6. Righting reflex
7. Stands back up
Look at live animals in yard so you can recognize a natural spontaneous blink or a threat (menace) blink.

Source: beefmag.com

Source: Countrysidenetwork.com
• Both spontaneous blinking and threat (menace) reflex look the same

• The eyelid does a complete close then open cycle
Understand Differences in the Behavior of the Unconscious Animal After Different Methods of Stunning

- Methods that physically damage large parts of the brain
- Methods that do not cause gross physical damage
Captive Bolt or Gunshot

- Agonal gasping must be absent (like a fish out of water)
- Nystagmus (vibrating eye) must be absent. Do not confuse with natural blinking
- An animal exhibiting the above signs should be immediately restunned
Electrical or CO₂ Stunning

- Agonal gasping may be present like a fish out of water in a properly stunned animal.
- Do not confuse with rhythmic breathing where the ribs must move in and out at least twice.
Electrical or CO$_2$ Stunning

- Nystagmus (vibrating eye) may be present in a properly stunned animal
- See chart in NAMI 2017 Guidelines
Stunning Principles
Review
Captive Bolt
Well-designed cattle stun box
When animals slip, they become agitated. Slick floors are number one stun box problem

Must have non-slip flooring
Non-slip floor prevents the animal from becoming agitated from slipping.

Calm animals entering the box or restrainer are easier to stun.
Stunning cattle with penetrating captive bolt

The two most common causes of captive bolt stunning failure:

- Poor gun maintenance
- Damp cartridges
Stun Box with Head Restrainer
Stunning with a pneumatic powered captive bolt

Note curtain to block the vision of the next animal
Three Parts of a Pneumatic Stunner that Must be Maintained

✓ The Stunner
✓ The Compressor
✓ The Balancer
Cartridge Fired Hand Held Penetrating Captive Bolt

Correct Stun

Incorrect Stun
Captive Bolt Pneumatic Stunner

No brainstem disruption
Using a high-powered Jarvis Pneumatic Stunner, feedlot cattle can be effectively stunned even when the shot is slightly on an angle.

Brainstem may not be penetrated.
Captive Bolt Shooting Positions for Cattle

Horned

Polled

Credit: J.K. Shearer, AVMA 2013
Captive Bolt Shooting Positions for Sheep and Pigs

Pig

Sheep

Credit: J.K. Shearer, AVMA 2013
Head Holder For Use With Non-Penetrating Captive Bolt
Indentation in the skull from non-penetrating captive bolt
Non-Penetrating Captive Bolt

- Require more precise positioning than penetrating
- Effective stunning and brain damage are opposing goals
- Less effective on cattle with thick hair. Will not work on large bulls
- Must bleed within 60 seconds
Cattle riding on the restrainer
Diagram of center track conveyor system for a large plant
Stunning Principles
Review
Electrical Stunning
Both sides of restrainer must run at the same speed
Two Types of Electric Stunning

- Head Only – Must bleed within 15 sec. Often used for Halal (Muslim) slaughter of sheep because it is completely reversible
- Cardiac Arrest – Must bleed within 60 sec.
Head Only Reversible
Stun Correct Position
The extended wand tips and extra star wheels (spurs) assure correct stun wand contact with brain

Locate wand as close to the ear as possible, in the thin crevice. Note that this wand has two sets of star wheels for small and large pigs.

Longer, wider wand tips help to facilitate secure contact on the head of larger pigs.

Credit: Erika L. Voogd
For pigs larger than 200 pounds, extend wand tips to assure correct stun wand contact

Extended tips with extra star wheels. Stainless steel star wheels (spurs) conduct better than carbon steel

Credit: Erika L. Voogd
Procedure for Small Plants

After head only stunning, apply electrode to the heart to prevent return to sensibility

Vogel et al., 2010
Insulate the stun box to prevent grounding during stun.

- Truck rubber mats on floor and wall.
- Coated metal gate
- Plastic lining in stun box area to insulate electrical current

Credit – Erika L. Voogd
Head to body cardiac arrest stunner
In small plants, many pigs that are head only stunned regain sensibility because the hoist is very slow. A simple solution to the problem is to apply the stunner to the head first and then apply it a second time to the chest to stop the heart (photograph courtesy of Erika Voogd)
Red dots correct – Arrows wrong
Current fails to pass through the brain
Electrodes must be positioned so the current goes through the brain

Location of Pig Brain
EEG brainwaves used to determine that a proper stun induces a grand mal epileptic seizure
**Minimum Stunner Amperage Settings**

<table>
<thead>
<tr>
<th>International OIE Standard</th>
<th>1.25 Amps for pigs – Pigs heavier than 280 lbs. may require 2 amps</th>
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<tr>
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<td>1.00 Amps for sheep and cattle</td>
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Electric stunning must induce an epileptic seizure with a Rigid Tonic Phase and Clonic (kicking) Phase.
- Cardiac arrest stunning will mask intense seizure activity
- Ghost seizure is usually visible with a slight rigid and tonic phase
Waveform of a good stun where the animal receives the full intensity and duration of the current.

Waveform of a correct stun.
Neville Gregory 2001
Waveform of bad stuns

Poor contact with the animal

Interrupted current (double stunning) and poor contact

Waveforms of poor stuns - Neville Gregory 2001
TROUBLE SHOOTING

Electric Stunning

- Dehydrated animals
- Poor bleeding
- Poor contact
- Low amperage
- Animals not wetted
All Methods of Stunning

- Ignore kicking limbs
- Kicking can still occur after the head is removed
- The walking circuit is located in the middle of the back
Completely insensible steer with a floppy head, straight back and no righting reflex

Ignore kicking
The tail lies down flat when the spinal reflexes stop.
Completely insensible pig

In electrically stunned animals, ignore kicking, gasping is permissible
- Flaccid fully extended tongue is unconscious
- Sometimes the tongue does not fully extend in an unconscious, properly stunned animal
CO₂ Pigs Limp and Floppy

Slight limb movements and gasping may occur
There is Zero Tolerance for Hoisting an Animal that is Showing Obvious Signs of Sensibility

There is Zero Tolerance for:
- Skinning, Scalding, Dehairing or Removal of any Body Part on an Animal that Shows any Sign of Partial Return to Sensibility
- It MUST be brain dead
Low stress group handling for CO\textsubscript{2}
Best Practice:

Inspection port on CO$_2$ machine for observing anesthesia induction
Control of forward movements of crowd gate by a person prevents overcrowding