



## Evaluation of current practices and presentation of recommendations for improvements to permissible methods

Dialrel Final WS 15th and 16th March 2010, Taxim Hill Hotel, Taksim, Istanbul

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Haluk Anil, Cardiff University

### This presentation is based on the following work

to improve methods  
of religious slaughter  
by Holleben, Velarde, Anil  
2010

- **Spot visits to slaughter plants, performed during WP2.2 in EU countries (Belgium, Germany, Italy, The Netherlands, Spain and The UK), Turkey and Australia in 18 cattle, 12 sheep, and 5 poultry abattoirs**  
Antonio Velarde, Pedro Rodriguez, Antoni Dalmau, Carmen Fuentes and Pol Llonch (IRTA, Spain), Karen von Holleben (BSI Schwarzenbek, Germany), Haluk Anil (Cardiff University, UK), Beniamino Cenci Goga and Bernardo Catanese (University of Perugia, Italy), Bert Lambooij (ASG Veehouderij, the Netherlands), Helmut Pleiter (Meat and Livestock, Australia), Azmi Yuksel (Veteriner Halk Sagligi Dernegi, Turkey), Tahsin Yesildere (Istanbul Veteriner Hekimler Odasi, Turkey).
- **A comprehensive report summarizing animal welfare concerns in relation to slaughter practices from the viewpoint of veterinary sciences, including practical observations:** K. v. Holleben, M. v. Wenzlawowicz, N. Gregory, H. Anil; A. Velarde, P. Rodriguez, B. Cenci Goga, B. Catanese B. Lambooij Dialrel-deliverable 1.3, [www.dialrel.eu/dialrel-results](http://www.dialrel.eu/dialrel-results)
- and



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- **Two days Workshop: Religious slaughter practices, Girona (Spain), 3rd / 4th of February 2010** Hamid Ahmad (United Casing Corporation, Pakistan); Lotta Berg (Swedish University of Agricultural sciences, Sweden); Clyde Daly (Carne Technologies, New Zealand); Bruno Fiszon (Le Grand Rabbinate de France, France); Troy Gibson (Royal Veterinary College, UK); James Kirkwood (Universities Federation for Animal Welfare, UK); Rasto Kolesar (World Society for the Protection of Animals, UK); Luc Mirabito (Institut de L'elevage, France); Mohan Raj (Bristol University, UK); Joe Regenstein (Cornell University, USA); Shuja Shafi (The Muslim Council of Britain, UK); Yunes Teinaz (The Muslim Council of Britain, UK); Tahsin Yesildere (Istanbul Veteriner Hekimler Odasi, Turkey).
- **The presentation represents the view of the authors and does not necessarily represent a position of the delegates of the workshop!**



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**WARNING:**

- This presentation can be misleading  
without considering further information.
- For further information and full reference list  
please see  
<http://www.dialrel.eu/images/veterinary-concerns.pdf>

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- Restraining methods
- Neck cutting without stunning
- Post-cut period  
- animals slaughtered without stunning
- Reversible stunning



picture HSA, UK



photo: <http://sheepgoatmarketing.info/news/HumaneSlaughter.pdf>

**WARNING:**

- This presentation may look  
incomplete because pictures had  
to be removed because of  
publication issues

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**General requirements to restraint**

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- restrict movement / hold animal without stress
- present the animal in an optimum position
  - for **application of the cut**  
+ during the **bleeding period**  
(Slaughter without stunning)
  - for **application of stunning device**  
+ subsequent **quick cutting/bleeding**  
(Slaughter after stunning)
  - for **application of the cut + subsequent**  
**quick stunning** (Post cut stunning)

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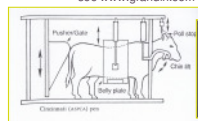
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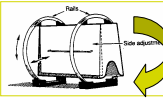
## Restraining methods: Example cattle

- upright restraint,



see [www.grandin.com](http://www.grandin.com)

- inverted 180° (on the back)



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photo NAVI,  
NL

- inverted 45°/90° (on the side)

Photo: only to be taken as  
an example for self  
constructed equipment;  
Rotary pens can be also  
used for turning to 45°/90°



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## Restraining methods: Example sheep

- upright restraint



photo: <http://sheepgoatmarketing.info/news/HumaneSlaughter.pdf>

- lying on the side

photo removed

- shackled



- Stressful restraint,  
could take several minutes until  
performance of the cut
- Animals are not relaxed during  
bleeding

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## Restraining methods: Example poultry

- By hand



photos removed

- Cone/ funnel

photos: bsi

- Shackled



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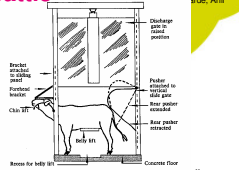
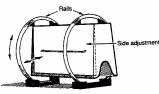
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## Example: restraint - cattle



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Bräde, Anil

www.grandring.com

- **Rotary type** (chinlift, backpusher), every degree of turning possible from „upright“ to „on the back“

- **Upright type** (chinlift (bellylift), backpusher)

- ❖ Impediments at entrance, e.g. incline, floor
- ❖ Excessive pressure on the animal (effect on stress, bleeding)
- ❖ Poorly designed headholder or chin lift (cut not performed correctly),
- ❖ Operation bumpy and not smooth

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→ These problems happen with both types of restraint

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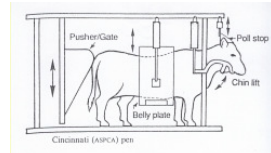
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## restraint – cattle - upright



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Pros & Cons

„Upright type“ pens  
also called  
„Cincinnati type“  
„ASPCA-type“

- Animal enter calmly,
- Possible to fix the head and present the neck within short time and at low stress level („good performance“: < 10 s)
- Good bleeding results because of calm animals
- People must be skilled, to perform a good cut in upright position („better performance“: 2-12 cutting movements )
- If the animal (700 kg ) is not well held/ well managed after the cut, it may go down with the wound falling into the neck frame
- Blood irritates wound (also enters larynx, bronchi)

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## restraint – cattle – turned on the back

Pros & Cons „(Weinberg)“, „Turning pens“, „Rotary pens“

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- High working safety, also with struggling animals
- Cut may be easier to perform, if cattle are turned on the back (+: 2-12 cutting movements )
- Often stress during driving in, head restraint and turning, times until restraint ↑, vigorous ↑ and longer periods of struggling, vocalisations ↑, laboured breathing ↑, foaming at the mouth ↑, serum cortisol ↑, haematocrit ↑; (Dunn 1990, Koorts 1991).
- Discomfort due to rumen pressing upon the diaphragm and thoracic organs
- Signs of aversiveness/recovery often masked by facilities
- Blood and rumen content irritate wound (also larynx, aspiration of fluids)



- In some countries operated in recumbent position (90°/45°)

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## restraint – cattle – turned / tilted

Examples : intermediate turning positions (e.g. 45°, 90°)

- electrical stunning performed during turning
- post cut stunning after turning to 45°

photos removed

Potential of turning to intermediate positions

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## Design: access to perform the neck cut

Cattle:	rotary	upright
	photos removed	photos removed
	<ul style="list-style-type: none"> <li>• impaired access for neck cutting</li> <li>• cut may be difficult to perform, especially in smaller cattle</li> </ul> <p>turning times:</p> <ul style="list-style-type: none"> <li>• external axis: Ø 52 s</li> <li>• center axis: Ø 8-12 s</li> </ul>	<ul style="list-style-type: none"> <li>• construction mistake access for neck cutting impaired</li> </ul>

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## Recommendations - restraining

- **Due care** during loading the animal;
- **Design:** properly lighted, non-slip flooring, where contact to animal: smooth rounded surfaces;
- A restraining device or method must **suit the size and species** and type of animals slaughtered;
- use concept of **optimal pressure**: hold the animal firmly enough to facilitate slaughter without struggle or undue delay but avoid excessive pressure;
- The restraining device or method must allow the correct **application of the bleeding cut**; adequate neck tension
- Post cut: allow good bleed-out, further processing only when unconscious, avoid stimuli on wound, allow intervention (see later)

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## Recommendations – restraining ff.

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Cattle:

- Although **lateral recumbency and upright restraint are preferred**, when **rotary pens** are used they **must operate smoothly** and at an appropriate uninterrupted speed;
- Upright restraint: the **belly plate must not lift the animal** or any of its feet off the floor;
- Rotary pens: the **head of the animal must be restrained before** the start of the turning process;

Poultry:

- Preferred method for Kosher and Halal Slaughter: one person **holds the bird** whilst the other performs the cut;
- When birds are shackled, the **duration of shackling before the cut must be kept to a minimum (1 min)**;

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## Slaughter without stunning – the cut

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### A) What happens?

- **Tissues that are cut:** skin, long hyoid bone muscle, trachea, oesophagus, both jugular veins, both common carotid arteries, both trunci vagosympathici, both nervi recurrentes, both trunci jugulars and parts of the long throat muscle (König, 1999)
- **Most of these tissues are well supplied with nociceptors**

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## About pain:

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- Pain is an unpleasant sensory or emotional experience associated with actual or potential tissue damage.
- Large wounds elicit a major pain response
- There are **different qualities of pain**:
- **Phasic** or **nociceptive pain** = "first pain" (mechanical or thermal stimuli).
- **Tonic** or **inflammatory pain** = "second pain" (chemical stimuli released by injury and inflammations)
- Both forms are produced during slaughter
- Only inflammatory pain can be influenced by the quality of the cut.

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### B) How to measure pain?

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- Physiological indicators (e.g. blood metabolites hormones, heart rate)
- BUT:** these react too slowly or are confounded by the process of slaughter
- Behavioural indicators are most important
- BUT:** very difficult to standardize
- Brain electrical activity

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### B) How to measure pain - behaviour

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- Very variable behavioural signs**  
(e.g. licking, wide open eyes, muscle tremor, motionless, struggling, withdrawal, vocalising)
- Expression by the animal may be faint or hidden**
- Different statements by scientists:**
  - little or no reaction to the throat cut by calves / cattle, except for a slight flinch (Grandin Regenstein 1994)
  - defence movements even at optimum conditions (Hazem et al. 1977, one calf out of 10)
  - neck movement 4 of 100 chicken (Barnett et al 2007)
- Dialrel (variable practices):**
  - Cattle:** vocalizing, retract, shivering, struggling
  - Sheep:** struggling, shivering
  - Poultry:** retract, wing flapping

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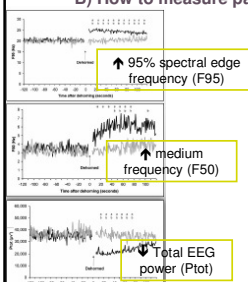
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### B) How to measure pain – brain electrical activity



Recent work by Gibson et al. 2007/2009  
(EEG spectral analysis):

- Characteristic pain response (amputation dehorning in calves)
- This response is present during ventral neck cutting (calves)
- This response was due to incision and not loss of blood flow to the brain

→ **Conclusion: Ventral neck incision is noxious.**

Gibson et al., 2007  
New Zeal vet J 55, 152-157  
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### C) Performance of the cut

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- **Number of cuts/ swifts of knife**  
Dialrel: ("better conditions"):  
**Cattle: 1-12** (↔ up to 60 ("bad" conditions))  
**Sheep: 1- 6**  
**Poultry: 1**
- **Halal Ø 5.2** (n=116) / **Shechita Ø 3.2** (n= 231)  
(Gregory et al. 2008)
- **Multiple cuts/ additional cuts**  
potential for further nociceptor activation
- **Sharp knife, long enough, cutting all the vessels, smooth, one non interrupted cut,**

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## Slaughter without stunning – the cut

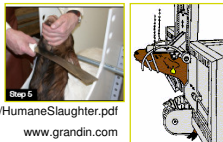
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### C) Performance of the cut

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- Scratching on the spinal bone causes additional pain.
- Severance of the spinal cord causes additional pain.
- Neck breaking causes additional pain.
- Clinical signs post cut can be masked.

How far stretch the neck ?



photos: <http://sheepgoatmarketing.info/news/HumaneSlaughter.pdf>  
[www.grandin.com](http://www.grandin.com)

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### C) Performance of the cut

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- **To control the performance of the cut!**
- Only **one carotid artery cut** **chicken:** 42%  
(Shechita, Gregory and Wotton 1986)
- Only **one carotid artery cut** **cattle :**  
**Halal 1%** (n=116)  
**Shechita 6%** (n= 231)  
(Gregory et al. 2008)

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## Recommendations – cutting

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- Delays between restraint and the neck cut must be minimized.
- Cut should be performed by a **rapid swift knife stroke** with ideally **no sawing motions**. Ideally the cut should be performed by **one single continuous movement** of the knife.
- **Both carotid arteries and jugular veins** must be cut without touching the bones of the spine (vertebrae) with the knife.
- **No neck breaking** together with the cut.

The final version of the recommendations will be discussed following the Istanbul workshop!

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## Recommendations – cutting ff.

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- The knife used must be **sufficiently long** for each animal to minimize the need for multiple cuts. Ideally, the knife should be **twice the length of the neck**.
- The knife must be **sharp** for each animal.
- The **knife should be checked** between each animal.
- The **cut should be inspected carefully** without touching the outer cut surfaces, for complete section of both carotid arteries and jugular veins (for efficiency of bleeding, see later).
- If the **cut is incomplete** there must be immediate **remedial stunning** and slaughter.

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## Slaughter without stunning – post cut

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### After the cut

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- How long can consciousness last and why?
- What are the possible impacts on the wound?
- When can we further process animals?
- How do we recognize that they are definitely unconscious?
- What do we do in case of prolonged consciousness or if they re-awake?

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## Slaughter without stunning – post cut

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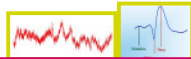
Time to loss of consciousness:

→ Cattle: Ø 20 s  
( 5-80 s ..... up to 4 min /5 min)

photo  
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→ Sheep: Ø 15 s  
(2-22 s ..... up to 2 min)

→ Poultry: Ø 15 s  
(12-25 s .....up to ??)



Different criteria to be  
considered differently !

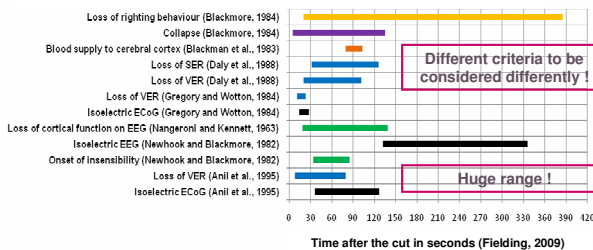
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### Range for loss of brain function in calves/ cattle



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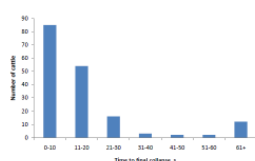
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Time to collapse after Halal slaughter (n= 174):

- time to collapse: Ø 20 s

- 14% collapsed and stood up again ( their time to final collapse: Ø 49 s)

- 8% of cattle took longer than 60 s to collapse
- 2 /174 took more than 4 minutes to collapse



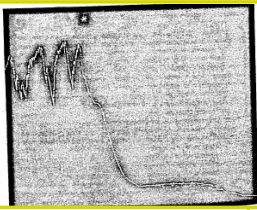
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Gregory et al., 2010 Meat Science 85, 66-69

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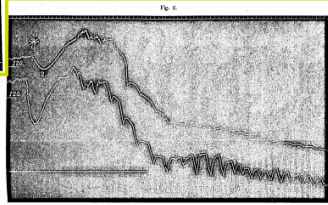
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**Example: blood pressure  
does not drop immediately  
in all animals**

Lieben, 1925



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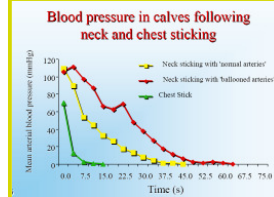
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**Example: False aneurysms in cattle**



Gregory et al., 2008 and 2010



Anil et al., 1995

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➔ **Some animals take longer than others  
to lose consciousness**

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Possible impacts on the wound after the cut:

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- Mediators by the cut tissue,
- Blood borne metabolites
- Mechanical impacts like tearing,  
touching other material,  
e.g. metal
- Wound surfaces touch each other
- Stomach content
- Air draughts

**These impacts are animal welfare concerns as  
long as the animals are conscious !**

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### **Mechanical** impacts on the wound after the cut:

pictures (removed): example animal (cattle) goes down after upright restraint, wound surfaces touch neck frame in the frontside of the pen, animal lifts the neck

pictures (removed): contact of the wound surfaces to the head gate can also happen in rotary pens (cattle)

pictures (removed): mechanical impacts to the wound in sheep lying on the floor/ or sheep lying on the table if the head is not supported after the cut/ hanging down

pictures (removed): mechanical impacts to the wound in shackled sheep

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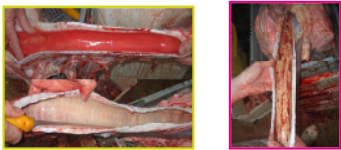
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### Impacts on the wound after the cut:



Gregory et al 2009, Meat Science 82, 13-16

- ➔ Blood aspiration is a potential welfare concern
- ➔ Blood sputtering on the **larynx/ glottis** is a welfare concern
- ➔ the cough reflex cannot be expressed because of severance of the respective nerves

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## Slaughter without stunning – post cut

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➔ **Bleed-out is best,**  
if the animal is  
relaxed !

- When can we further process animals?
- How do we recognize that they are definitely unconscious?

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## Assessment of consciousness following slaughter without stunning

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consciousness is defined as the state of being aware of and responsive to the environment and physical sensations.  
Requires an active awareness of the body or parts of the body, which allows some degree of awareness of the environment, including auditory, olfactory, gustatory or tactile cues, whereby reflexes are defined as involuntary, preprogrammed, and rapid responses to a stimulus without requiring cognitive or conscious input or processing, which can be tested by palpation.

**Signs of consciousness**  
Rhythmic breathing  
Corneal reflex  
Wide relaxed pupil/ eyeball rolls back  
Eye tracking of movements/ focused eye movement/ often together with spontaneous blinking (conscious)  
Rhythmic breathing (may persist long, also in unconscious animals)  
Gasping (does not indicate consciousness)  
Vocalization (cannot be expressed if throat is cut)  
Kicking (may also be unconscious due to lost inhibition of spinal patterns)  
Wing flapping (may be unconscious, but often indicates consciousness)  
No collapse / Righting (requires cortex, proprioception, muscle tone) (conscious), (⇒ floppy head in shackled animals = mostly unconscious)

Signs*	Physiological implication	Comments
Rhythmic breathing	Rhythmic breathing is coordinated by the brainstem. Absence of rhythmic breathing indicates lost consciousness.	Rhythmic breathing alone does not indicate consciousness but can be taken as a sign that the brain is reorganizing e.g. after stunning. Breathing may be present for several minutes after the cut in unconscious animals (Blackmore, 1984).
Corneal reflex	Reflex action of the eye in response to a stimulus on the cornea. It is a protective reflex that causes the eye to blink. It is a reflex that is mediated by the trigeminal nerve (V) and the facial nerve (VII).	The absence of corneal reflex after slaughter indicates a loss of consciousness. It is a reflex that is mediated by the trigeminal nerve (V) and the facial nerve (VII).
Wide relaxed pupil/ eyeball rolls back	Wide relaxed pupil/ eyeball rolls back is a sign of unconsciousness. It is a reflex that is mediated by the trigeminal nerve (V) and the facial nerve (VII).	The absence of wide relaxed pupil/ eyeball rolls back after slaughter indicates a loss of consciousness. It is a reflex that is mediated by the trigeminal nerve (V) and the facial nerve (VII).
Eye tracking of movements/ focused eye movement/ often together with spontaneous blinking (conscious)	Eye tracking of movements/ focused eye movement/ often together with spontaneous blinking (conscious) is a sign of consciousness. It is a reflex that is mediated by the trigeminal nerve (V) and the facial nerve (VII).	The presence of eye tracking of movements/ focused eye movement/ often together with spontaneous blinking (conscious) after slaughter indicates consciousness. It is a reflex that is mediated by the trigeminal nerve (V) and the facial nerve (VII).
Rhythmic breathing (may persist long, also in unconscious animals)	Rhythmic breathing (may persist long, also in unconscious animals) is a sign of consciousness. It is a reflex that is mediated by the trigeminal nerve (V) and the facial nerve (VII).	The presence of rhythmic breathing (may persist long, also in unconscious animals) after slaughter indicates consciousness. It is a reflex that is mediated by the trigeminal nerve (V) and the facial nerve (VII).
Gasping (does not indicate consciousness)	Gasping (does not indicate consciousness) is a sign of unconsciousness. It is a reflex that is mediated by the trigeminal nerve (V) and the facial nerve (VII).	The absence of gasping (does not indicate consciousness) after slaughter indicates unconsciousness. It is a reflex that is mediated by the trigeminal nerve (V) and the facial nerve (VII).
Vocalization (cannot be expressed if throat is cut)	Vocalization (cannot be expressed if throat is cut) is a sign of unconsciousness. It is a reflex that is mediated by the trigeminal nerve (V) and the facial nerve (VII).	The absence of vocalization (cannot be expressed if throat is cut) after slaughter indicates unconsciousness. It is a reflex that is mediated by the trigeminal nerve (V) and the facial nerve (VII).
Kicking (may also be unconscious due to lost inhibition of spinal patterns)	Kicking (may also be unconscious due to lost inhibition of spinal patterns) is a sign of unconsciousness. It is a reflex that is mediated by the trigeminal nerve (V) and the facial nerve (VII).	The absence of kicking (may also be unconscious due to lost inhibition of spinal patterns) after slaughter indicates unconsciousness. It is a reflex that is mediated by the trigeminal nerve (V) and the facial nerve (VII).
Wing flapping (may be unconscious, but often indicates consciousness)	Wing flapping (may be unconscious, but often indicates consciousness) is a sign of consciousness. It is a reflex that is mediated by the trigeminal nerve (V) and the facial nerve (VII).	The presence of wing flapping (may be unconscious, but often indicates consciousness) after slaughter indicates consciousness. It is a reflex that is mediated by the trigeminal nerve (V) and the facial nerve (VII).
No collapse / Righting (requires cortex, proprioception, muscle tone) (conscious), (⇒ floppy head in shackled animals = mostly unconscious)	No collapse / Righting (requires cortex, proprioception, muscle tone) (conscious), (⇒ floppy head in shackled animals = mostly unconscious) is a sign of consciousness. It is a reflex that is mediated by the trigeminal nerve (V) and the facial nerve (VII).	The presence of no collapse / Righting (requires cortex, proprioception, muscle tone) (conscious), (⇒ floppy head in shackled animals = mostly unconscious) after slaughter indicates consciousness. It is a reflex that is mediated by the trigeminal nerve (V) and the facial nerve (VII).

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See <http://www.dialrel.eu/images/veterinary-concerns.pdf>, pp 11-12

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## Slaughter without stunning – assessment of permanent consciousness post cut

to improve methods of religious slaughter  
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- ☹ Corneal reflex (may persist long, also in unconscious animals if absent, consciousness is lost)
- ☹ Wide relaxed pupil/ eyeball rolls back (may be transient state)
- 😊 Eye tracking of movements/ focused eye movement/ often together with spontaneous blinking (conscious)
- ☹ Rhythmic breathing (may persist long, also in unconscious animals if absent consciousness is lost, if present .....)
- ☹ Gasping (does not indicate consciousness)
- ☹ Vocalization (cannot be expressed if throat is cut)
- ☹ Kicking (may also be unconscious due to lost inhibition of spinal patterns)
- 😊 Wing flapping (may be unconscious, but often indicates consciousness)
- 😊 No collapse / Righting (requires cortex, proprioception, muscle tone) (conscious), (⇒ floppy head in shackled animals = mostly unconscious)

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## Slaughter without stunning – assessment of permanent consciousness post cut

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- 😊 cognitive threat test (Threat stimulus: rushing the hand towards the eyes ⇒ closing of eyes / moving the head backwards

(requires perception of stimulus and motor response  
⇒ indicator of consciousness) (Limon et al. 2010)

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## Recommendations – post cut period

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- During bleeding animals shall be held **secure but as relaxed as possible**.
- **No further processing of the animal** after the cut before the **loss of consciousness**.
  - establish criteria for loss of consciousness
  - if methods not in place, wait 3/2 min (cattle/sheep).
- **No interference with the wound** until the animal is unconscious.
- **Minimize mechanical and chemical stimuli** on the wound!

The final version of the recommendations will be discussed following the Istanbul workshop!

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## Recommendations – post cut period ff.

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- In case of **prolonged consciousness** after neck cutting, **animals must be stunned**.
- Signs of prolonged consciousness suggested:
  - attempts to regain upright body posture
  - reactions to manipulations of the wound
  - eye tracking of movements in the vicinity
  - threatening response

The final version of the recommendations will be discussed following the Istanbul workshop!

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## Reversible electrical stunning

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of religious slaughter  
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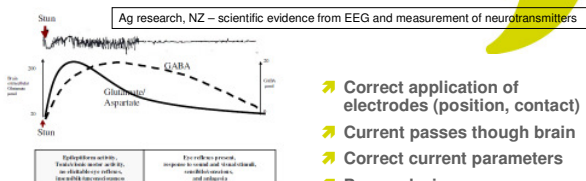


photo bsi

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- Correct application of electrodes (position, contact)
- Current passes through brain
- Correct current parameters
- Proper device
- Instantaneous effect
- Epileptic fit (tonic/clonic phase - signifies effective stunning)
- Quick bleeding, which is effective before animal re-awakes

## Reversible electrical stunning



photos bsi



Proper equipment

- ✎ Bad maintenance of equipment
- ✎ Bad electrode position
- ✎ bad electrical contact
- ✎ improper performance/ equipement is a welfare concern

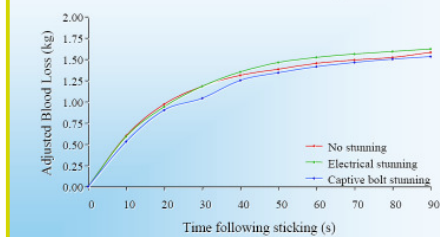
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## Example: Stunning – effect on bleeding ?

### Comparison of slaughter methods - on blood loss in sheep -



Anil M. H., Yesildere T.; Aksu, H.; Matur, E.; McKinstry, J.L.; Erdogan, O.; Hughes, S.; Mason, C. (2004): Comparison of religious slaughter of sheep with methods that include pre-slaughter stunning, and the effect of differences in exsanguination, packed cell volume and meat quality parameters. *Animal Welfare* 13, 387-392

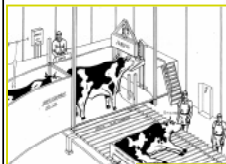
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## Reversible electrical stunning - cattle



photo replaced



photos Jarvis, NZ



- ✎ right electrode position
- ✎ keep electrical contact

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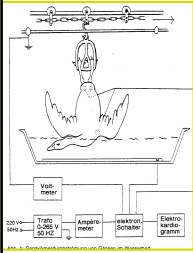
- ✎ quick and effective bleeding

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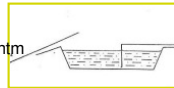
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## Reversible electrical stunning - poultry

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- adequate equipment
- uniform immersion of all birds (head and neck)
- moistening of shackles
- current parameters and duration of current flow
- prevent pre-stun shocks



See also: <http://www.heyndes.de/isa/schlachtung/bet-en.htm>

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## Reversible electrical stunning - poultry

Importance of good bleeding in poultry slaughter

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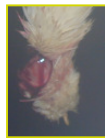
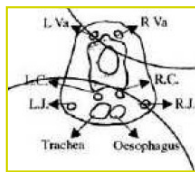
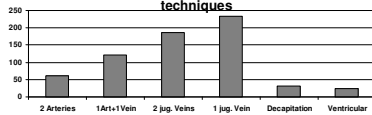


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Time to loss of brain function (s) for different cutting techniques



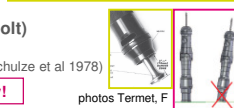
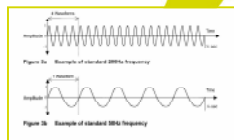
Gregory and Wotton 1986 – anaesthetized chicken – to consider range of differences

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## Reversibility of stunning methods

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- **Electrical stunning:**
  - Correct electrode position and choice of current parameters will prevent, that heart fibrillation occurs;
  - Heart continues to beat after current flow stops (Gregory, 1998a)



- **Mechanical stunning methods** (non penetrative\*/ penetrating captive bolt)
  - Regular heart activity up to 4 minutes (e.g. Cattle: Vimini et al 1983, Kaegi 1988/ Sheep: Schulze et al 1978)
  - **stunning effectiveness not satisfactory!**

photos Termet, F



- **Gas stunning (poultry, used for Halal slaughter)**
  - Regular heart beat for minimum 250-320 seconds after end of gas exposure (Coenen et al 2003)

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photos Stork, NL


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### Control of effective stunning

- Electrical stunning:**
  - rigid body (flexed hind legs, collapse) during current flow
  - then typical tonic clonic cramps = signs of an epileptic fit
  - during and after current flow: no rhythmic breathing, no righting, no vocalisation, no eye tracing of movements, no wing flapping
- Mechanical stunning methods (non penetrative / penetrating captive bolt)**
  - collapse, breathing stops
  - legs flexed, forelegs then straightening, clonic cramps may follow
  - no rhythmic breathing, no rotation of eyeball but fixed stare
- Gas stunning (poultry)**
  - relaxed body, no righting, no wing flapping,
  - no vocalization
  - no rhythmic breathing

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### Recommendations – Stunning

- Induce immediate loss of consciousness by adequately maintained equipment, properly operated according to species and size of animal
- Prompt neck cutting** to ensure that the animals do not re-awake during bleeding
- Animals must be **alive at the time of neck cutting** (monitor blood flow, pulsatility)
- Apply **criteria for effective stunning** according to stunning system and species
- Properly **re-stun animals in case** they show signs of re-awakening
- If **post neck cut stunning** is used, it has to be **applied immediately following the cut.**

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The most important achievement of this project is,  
that we have started the dialog with each other!



Thank You very much!



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