Euthanasia of laboratory animals
killing animals

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AIM

- Euthanasia as part of ethical approved protocol
- Regulatory demands to euthanasia methods
- Experimental reasons for selecting a special euthanasia method
- The "ideal" euthanasing agent
- Different methods of Euthanasia (overdose, KCl, CO2, decapitation, cervical dislocation, out-bleeding, microwave oven)
- Methods that are NOT acceptable for killing animals.
- For reflection: Naming of killing animals.
Euthanasia

- The humane killing of laboratory animals may be included as an endpoint of an experiment or be implemented as a legal requirement.

- In selecting a method, it is important to take into account the purpose for which the animal is being killed.

- Whichever method for euthanasia is to be used, it must be carried out humanely, causing absolutely the minimum amount of anxiety and pain to the animal.

- Dyrevernloven § 9 Avliving: “Avliving av dyr skal gjerast på slik måte at dyret ikkje kjem i fare for å lida i utrengsmål”/”killing without causing suffering”

Ideal euthanasing agent

- Not cause anxiety, alarm, fear, vocalization, muscular spasms or clinical sign of autonomic activation.
- Painless
- Fast acting
- Reliable - work properly every time
- Safe to use for properly trained person
- Easy to use for properly trained person
- Not be tempting to drug abuse for humans.
- Esthetically acceptable
- Practical to use
- Economically
- Not pollute environment
- Not cause tissue changes
Euthanasia methods

Overdose of Anesthetic drug

- Overdose pentobarbitone (e.g. 120mg/kg body weight) intraperitoneally (i.p.) kill most species after first passing into gentle sleep
- As end point in non-recovery surgery or after sedation

Cadiac arrest using KCl

- Cardiac arrest using saturated KCl iv
- Cheap
- Fast
- Only be used on animals in deep anesthesia
Carbon Dioxide - \( \text{CO}_2 \)

- Rats and mice placed in a transparent Perspex chamber
- able to observe during exposure to the carbon dioxide
- Expose the animals to a slowly rising concentration of gas.
- This will ensure that the animal loses consciousness because of the effects of carbon dioxide to the CNS, rather than suffocating because of immediate exposure to 100\% \( \text{CO}_2 \)

Carbon Dioxide - \( \text{CO}_2 \)

- Rats or mice in transparent chamber
- (possible to inspect the animals)
- CO2 respiration stimulation
- Direct exposed to 100\% \( \text{CO}_2 \)
- Rapid loose of consciousness
- Bleeding on the lungs
- FDU expert opinions
  http://www.fdu.no/fdu/prinsippavgjorelses/
- The use of \( \text{CO}_2 \) is controversial!!!
Decapitation (Guillotine)

- Rats must be lightly sedated before they are placed in the guillotine and their heads chopped off
- Messy procedure
- Distressing by the operator
- If it is to be carried out humanely, it is important that the procedure is undertaken skilfully and rapidly

Cervical dislocation

- Young and adult mice, sedated rats
- A pair of scissors or an iron rod placed quickly across the neck and pressed down hard while the body is jerked backwards by pulling on the tail.
- This dislocates the neck
Bleeding

- Out bleeding of animals under total anesthesia
- Collecting blood/serum
- Slaughtering

"I have never seen a more grotesque animal experiments in my career in this field. This is just disgusting and scientifically unjustifiable, says juridical adviser Live Kleveland Kalsrud from Dyreavernalliansen to VG."

"Jeg tror ikke jeg har sett et mer grotesk dyreforsøk så lenge jeg har jobbet med dette området, det vil si i rundt ti år. Dette er rett og slett motbydelig og faglig sett helt uforsvarlig, sier juridisk rådgiver Live Kleveland Kalsrud i Dyreavernalliansen til VG."

"Vil sende 12 rotter i mikro-døden Dyrevernere i harnisk LILLEHAMMER (VG) Forskere ved NTNU har søkt om å få å avlive 12 rotter i et spesialbygd mikrobølgeapparat"
Killing rats in special made micro-wave apparatus

• Professor in neuroscience Ursula Sonnewald at Norwegian University of Science and technology (NTNU) was very surprised of the criticism

• "This is a more humane method to kill animals on compared to previous method"

• "The Microwave oven is designed specially for this purpose"

• "I think the main reason for the skepticisms is that it is actually called a microwave oven"

• "The rats die within less than a second because of very powerful microwaves"

• The trial is a part of research on epilepsy and brain disorders.

2000 Report of the AVMA Panel on Euthanasia
American Veterinary Medical Association

Microwave irradiation

Heating by microwave irradiation is used primarily by neurobiologists to fix brain metabolites in vivo while maintaining the anatomic integrity of the brain. Microwave instruments have been specifically designed for use in euthanasia of laboratory mice and rats. The instruments differ in design from kitchen units and vary in maximal power output from 1.8 to 10 kw. All units direct their microwave energy to the head of the animal. The power required to rapidly halt brain enzyme activity depends on the efficiency of the unit, the ability to tune the resonant cavity and the size of the radiation head. There is considerable variation among instruments in the time required for loss of consciousness and euthanasia. A 10 kw, 2,450 MHz instrument operated at a power of 9 kw will increase the brain temperature of 38 g mice to 78°C in 330 ms, and the brain temperature of 250 to 420 g rats to 94°C in 850 ms.

Advantages—(1) Loss of consciousness is achieved in less than 100 ms, and death in less than 1 second. (2) This is the most effective method to fix brain tissue in vivo for subsequent assay of experimentally induced chemicals.

Disadvantages—(1) Instruments are expensive. (2) Only animals of mice and rats can be euthanized with commercial instruments that are currently available.

Recommendations—Microwave irradiation is a humane method for euthanizing small laboratory rodents if instruments that induce rapid loss of consciousness are used. Only instruments that are designed for this use and have appropriate power and microwave distribution can be used. Microwave ovens designed for domestic and institutional kitchens are absolutely unacceptable for euthanasia.
Agents that should **not** be used

- Inhalation anesthesia in large species
- Magnesium Sulfate
- Cause excitement, alarm, vocalization
- Curariform drugs
- Narcotic drugs, sedatives
- Can be used for sedation

There are better alternatives to these

Strychnine
Nicotine
Cyanide gas or solution
Cardiac drugs
Water (drowning)
Air embolism

Choice of method

- Various histopathology changes may occur depending on the method of euthanasia used
- Cervical dislocation and decapitation: damage brain or the tissues in the cervical region
- All methods of euthanasia affect the lungs to some degree. In most cases it is simply mild congestion of the alveolar capillaries

Carbon dioxide affects the ultrastructure of the liver
- Intraperitoneal injection of sodium pentobarbitone produces
  - enlarged spleen, focal congestion of the intestinal serosa and
  - subcapsular necrosis of the liver and kidneys
Euthanasia Criteria

- Painless
- Fast, irreversible
- Stable and reproduceable
- Safe for the personal
- Simple and effective

Euthanasia: choice of methods

- Carbon dioxide or i.p. injection of sodium pentobarbiton
  - suitable for pulmonary studies

- Cervical dislocation and decapitation
  - suitable for examination of the abdominal viscera and obtaining biochemically normal (unaltered) tissues and cells
Euthanasia – killing of animals

- "Euthanasia“ "God død"
- professional expression used in veterinary medicine
- “put to sleep” “put him down” - can be misunderstood, also used on anesthesia
- “put out of his misery” or "end the suffering"
- Slaugther - Food production
- Butchering - More barbarian expression for slaughtering

- Hunting, fishing - wild animals killed for food or for the sport
- Harvest (norw: høste) Animals who are not intended for food, fur-bearing animals
- norw: "Høste av naturens overskudd"
- Exterminate - vermin/pest control
- Killed (drept), sacrificed (ofret)
- Terminated - The life the animal, not the animal itself
- Destroyed - killing of sick, wounded or unwanted animals

summary / AIM

EUTHANASIA AS PART OF ETHICAL APPROVED PROTOCOL
REGULATORY DEMANDS TO EUTHANASIA METHODS
EXPERIMENTAL REASONS FOR SELECTING A SPECIAL EUTHANASIA METHOD
THE "IDEAL" EUTHANASING AGENT
DIFFERENT METHODS OF EUTHANASIA
(OVERDOSE, KCL, CO2, DECAPITATION, CERVICAL DISLOCATION, OUT-BLEEDING, MICROWAVE OVEN)
METHODS THAT ARE NOT ACCEPTABLE FOR KILLING ANIMALS.
FOR REFLECTION: NAMING OF KILLING ANIMALS.

QUESTIONS?