PHYSIOLOGY LABS PRACTICAL TASKS

TASKS, PRINCIPLES, QUESTIONS

Anesthesia, Surgery, Autonomic nervous system (ANS)

AIM

- To know the effects of drugs interfering with ANS
- To provide complex care to living beings during surgery/anesthesia

TASKS

- Anesthesia control in our animals during our labs, vital function monitoring and support
- observation of effects of drugs interfering with ANS, respiration, heart activity (drugs administered during general anesthesia)
- “keep the patient alive” during anesthesia

WHAT

- Anesthesia:
    - PubMed: state characterized by loss of feeling or sensation. This depression of nerve function is usually the result of pharmacologic action and is induced to allow performance of surgery or other painful procedures.
    - Wikipedia: Anesthesia is the process of blocking the perception of pain and other sensations. It comes from the Greek roots an-, "not, without" and aesthētos, "perceptible, able to feel".
- Autonomic nervous system (ANS)
    - PubMed: The enteric, parasympathetic, and sympathetic nervous systems taken together. Generally speaking, the autonomic nervous system regulates the internal environment during both peaceful activity and physical or emotional stress. Autonomic activity is controlled and integrated by the central nervous system, especially the hypothalamus and the solitary nucleus, which receive information relayed from VISCERAL AFFERENTS.

WHY

- Why do we perform the anesthesia?
    - Unique chance of hands-on real-time effect of anesthesia of biological object.
    - Full care must be provided on time.
    - Unexpected situations might occur and must be immediately solved
    - Simultaneous monitoring of multiple physiological parameters (ECG, respiration, temperature, etc.) are demonstrated
    - Demonstration of complex nature of biological systems – effects and side-effects of drugs and how may delicate interventions cause irreversible changes

HOW

1. Get ready
    a. See the movie (available on PCs in the labs) demonstrating the procedure
    b. Check the setup (ECG monitor, thermometer, respiration rate sensor, Vernier system is used as usually in our labs)
    c. Check the animal (already anesthetized)
        i. Get and record weight (mainly for drugs administration)
        ii. Anesthesia depth (no reaction to pain)
        iii. connect sensors

2. Anesthesiology - start monitoring, **do not stop** till the end of the procedure. Frequently notice:
    a. ECG (normal HR is cca 350-500 bpm)
    b. Respiration (normal respiratory rate cca 60/min)
    c. Anesthesia (administer additional anesthetic if marked nociceptive reaction is observed. See #4 for dosing)
    d. Temperature (to prevent hypothermia and resulting arrhythmia and stress. DO NOT overheat the animal)
    e. Hydration (to prevent desiccation, specifically in GIT (abdominal cavity)
    f. Peripheral circulation (no acrocyanosis)

3. Pharmacology

    a. *Atropin* - parasympathetic inhibitor (parasympatholytic). It has a positive chronotropic effect on the myocardium. This substance can be used in bradycardia. Atropine blocks glandular secretion into the bronchial tree and can thus contribute to better airway patency.
        i. Timing:
            1. any time if CPR is considered or started, specifically:
                a. in severe bradycardia
                b. if respiration problems occur (bronchospasm, salivation, excessive bronchosecretion)
        ii. Dose 0.01 mg / kg i.v. or i.p.
        iii. watch the effect (typically after few minutes)

    b. *Adrenalin* – a sympathomimetic with a positive ino-, chrono-, dromo-, bathmo-tropic and proarrhythmogenic effect on the myocardium. Among other things, it is used as the pharmacological support of the myocardium during resuscitation.
    risks: development of malignant arrhythmia (eg ventricular fibrillation). Adrenaline has a very short half-life, its i.v. the application can be repeated at 5-minute intervals during resuscitation. It is safer to give it 10x diluted with water for injection (especially in children). Dose 0.01 mg / kg i.v. or i.p.

    c. *Pilocarpin* – an example of parasympathetic stimulator (parasymphatomimetic)

i. Not administered in our labs anymore (was used to stimulate the activity of parasympathetic in GIT organs, heart and lungs)
ii. Used mainly to treat dry mouth caused by Sjogren's syndrome, or to manage an open angle glaucoma – ocular hypertension

d. Administer *Thiopental* – anesthetic (barbiturate)
   i. Timing:
      1. any time anesthesia is insufficient, e.g.
         a. obvious specific reactions to pain are observed (**note: do not overdose –** do not administer if minor nonspecific nociceptive reaction appear)
         b. if respiration problems occur
   ii. Dose

1. to prolong anesthesia	15 mg / kg	i.v. or i.p.
2. to introduce anesthesia	40 mg / kg	i.v. or i.p.

   iii. watch the effect (typically few minutes to start, lasts typically 1-2 hours)

Solution of critical states - ventilatory and circulatory support of the rat during anesthesia:

Respiratory support:
Symptoms of hypoxia: cyanosis, irregular breathing, bradypnea, gasping, apnea. A drop in heart rate below 300/min is could be a sign of poor oxygenation**.**
Procedure**:** an improvised ambu-bag (resuscitation bag) for rats is put on the nose while constantly tilting the head. Breathe the animal at a frequency of about 60/min. Be sure that the animal's chest rises with each inflation. If airway patency is not ensured (insufficient tilt of the head), or if the tidal volume is too large (possibly too big balloon compression), you may accidentally inflate animal's GIT with air. Therefore, pay attention to the tilt of the head, the breathing frequency and the amount of tidal volume**.**

Circulatory support:
Symptoms**:** bradycardia (HR <250/min), arrhythmia (ventricular tachycardia, ventricular fibrillation), asystole…
Procedure**:** start a cardiac massage with one finger over the sternum or with two fingers on the sides of the chest with the highest possible frequency. See the ECG monitor until the condition improve or for at least 15 minutes.