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Guidelines for Safety in Veterinary Anaesthesia: Enclosure 2

Recommendations for the minimal monitoring of the patient during anaesthesia.

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Wishing to conform to European directives issued at various levels, ISVRA has decided to publish the following set of rules, as other Scientific Societies have already done.
ISVRA also hopes that this first publication of its suggestions may be of some use to Colleagues, with the aim of attracting the attention of bodies and people in charge of the technological and organizational updating of both public and private veterinary practices.

The monitoring of vital functions is an important part of anaesthesia, and its improvement will allow enhancement of safety in anaesthesia, bettering the quality of assistance we give our patients.
An appropriate monitoring of the patient may permit, under certain clinical conditions, to promptly detect alterations in vital functions which may be caused by side-effects of administered drugs, by faulty functioning of medical instruments, or by physiopathological alterations related to surgery.
In human medicine, minimal monitoring standards during anaesthesia, which were proposed by the Anaesthesia Department of Harvard Medical School (1) in 1986 have been widely accepted and applied in the USA and have been adopted by the American Society of Anaesthesiologists (2). Similar standards have been proposed in various European Countries and in South Africa (3-7).
This document, created by ISVRA Workgroup on Safety in Veterinary Anaesthesia after a similar SIAARTI document (SIAARTI stands for Italian Society of Anaesthesia, Analgesia, Resuscitation and Intensive Care), is meant to be a recommendation. It may be subject to further revision to update it to the clinical and technological progress in our field, while we hope it will be inserted in future suggestions from other societies or bodies.
Using a minimal instrumental monitoring system does not exempt the physician who carries out anaesthesia (since now on we will call him/her “anaesthetist”) from a constant and scrupulous clinical observation of the

patient. According to the anaesthetist in charge of the procedure, the monitoring levels recommended here will have to be adapted to each case or increased under certain peculiar pathological conditions, as is the case in cardiac and neuro surgery.

The definition of monitoring systems suggested in the present document has taken due account of simplicity of use, reliability, precision and non-invasiveness.
All the suggested equipment are not to be seen as simple alarm systems, but as instruments which can provide an essential monitoring system for patient's physiological and functional parameters and their modifications over the time.
In the following text, monitoring will be divided into "constant" and "periodical". By the word "constant", we mean "prolonged and uninterrupted". This feature is typical of some monitoring techniques such as ECG, body temperature, ventilation, end tidal CO_2, oxygen saturation.
The term "periodical" means "regularly repeated at short time intervals". This term refers to observation of the patient, recording of instrumental parameters or to special monitoring techniques which perform automatic surveys at fixed times (i.e. non-invasive arterial blood pressure monitoring.
As for "available" equipment, material or device, we mean an instrument not physically present in the theatre, but quickly available if needed.

Care of the patient during general anaesthesia

Constant assistance during anaesthetic and sedation techniques
General anaesthesia should be carried out by veterinary surgeon who has skills and knowledge in anaesthesia: his constant presence is necessary to provide proper anaesthesia and to monitor patient's vital functions. The same rule is applicable to regional anaesthesia and to sedation techniques which may imply the risk of losing consciousness or respiratory/cardiovascular complications.

Needs for distant control and/or monitoring
When a temporary physical risk for staff is present (x-rays, radiotherapy, CT, MRI), the direct control of the patient may be replaced, for a short time span, by an appropriate remote control, maintaining observation of the patient and of monitored parameters. It will be the anaesthetist's task to decide if this alternative is safe for the patient.

Taking over from an anaesthetist
The same anaesthetist who starts an activity on a patient should also conclude it. If this is not possible, the in-coming anaesthetist should receive adequate information on how anaesthesia is proceeding and on the settings of all instruments in use.

The time of substitution and all functional parameters of the patient at that moment should be recorded in the anaesthetic record.

Pre-anaesthetic check of drugs and equipment

We would like to stress that a correct functioning of the instruments to be used and the safety of connections with gas sources should be thoroughly checked before anaesthesia starts. The availability of both ordinary and emergency drugs and technical devices should also be controlled. The use of an anaesthetic gas analyser is recommended if the anaesthetist is using a low-flow circular breathing system, and necessary if using a closed circular breathing system. For the anaesthesia machine check, you may refer to the ISVRA paper on the subject.

Clinical and instrumental monitoring of respiratory function

Oxygenation
To make sure oxygen in the inspired gas mixture (FiO_2), blood and tissues of the patient is adequate the following approach is recommended:
Evaluation of blood and peripheral tissue oxygenation – Besides a periodic clinical evaluation of the patient, the use of a pulseoxymeter as a quantitative method to check oxygenation is recommended. Monitoring of oxygenation will have to be prolonged until dismissal from the operating theatre.
Inspired oxygen concentration assessment – It is highly desirable that each anaesthetic machine should have its own oxygen analyser to constantly measure the oxygen concentration in the inspired gas mixture. This device should have a visible and acoustic alarm, triggered by minimum and maximum concentrations.

Ventilation
Monitoring of ventilation is necessary at all times during anaesthesia. This monitoring should be done by the following methods:

- during a short-term anaesthesia, under spontaneous or manual ventilation using a mask, the observation of the rib cage expansion/reduction range and volume changes in the respiratory bag, chest auscultation, along with the monitoring of colour of mucosal membranes, may be considered an adequate survey. If available, the use of a MicroStream capnograph is advisable.
- During spontaneous or mechanical ventilation with tracheal intubation, ventilation should be monitored with the following systems, in addition to those reported above:
    a) a capnograph, to determine the level of end-of-expiration CO_2, is recommended if available;
    b) a spirometer, with sensor placed on the expiratory limb of the breathing system to assess gas volumes expired by the patient, is a

very effective monitoring to use in conjunction with the capnograph; the use of a spirometer is also recommended if available.

These two instruments should be equipped with visible and acoustic alarms, triggered by minimum and maximum levels.

Monitoring of patient's connection to the anaesthetic machine

The mechanical ventilator, if available, should be provided with an acoustic alarm system based on insufflation pressure, capable of signalling a patient's disconnection when the pressure in the circuit goes under a pre-fixed value for more than 20 seconds. The spirometer, but above all the capnograph, also represent useful alarm systems in case of patient's disconnection.

Clinical and instrumental monitoring of the cardiovascular system

We recommend the periodic clinical monitoring of the cardiovascular activity during general anaesthesia is not suspended, and we suggest that continuous ECG and heart frequency monitoring should become a common practice in all patients. This monitoring will have to be prolonged until dismissal from the operating theatre.

If a specific device is available, we suggest arterial pressure under general anaesthesia might be determined at intervals depending on the patient's clinical condition and, at any rate, not exceeding 10 minutes.

Useful information on the haemodynamic situation may also be obtained from capnography ($ETCO_2$).

Monitoring of body temperature

The maintenance of an adequate body temperature has to be ensured throughout every anaesthetic, bearing in mind that prevention of hypothermia should start at premedication and should end at recovery of standing position or later. Even though the anaesthetist may make use of clinical signs to detect raising/falling temperature, a continuous measuring method for body temperature is recommended in every operating theatre. If the patient is at risk of malignant hyperthermia, or when the use of temperature modifying techniques has been decided (i.e. hypothermia), body temperature should be constantly monitored.

Here too, capnography may provide useful information.

Monitoring of neuromuscular functions

When neuromuscular blocking agents (NMBA) are used, a neuromuscular function monitoring device should be available to monitor recovery of the neuromuscular junction. If a neuromuscular function monitoring device is not available, an indirect monitoring of recovery (i.e. a capnograph, or a

spirometer displaying airways pressure trace and tidal volume) can be used instead.

Recording monitored parameters

All instruments should be provided with a recording system of the monitored parameters which also allows a review of what has happened immediately before and after the event that triggered the alarm.
All parameters subject to clinical and instrumental observation should be inserted in the anaesthetic record.
Special procedures may be needed, which will require an interruption of instrumental monitoring: the anaesthetist's task will be to specify the time and reasons of this interruption in the record. When all this occurs, clinical monitoring should be intensified.

ISVRA Task Force for Guidelines on Safety in Veterinary Anaesthesia

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