Total IV Anesthesia

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The accepted best practice for anesthesia has been to induce the patient with and injectable drug, intubate, and maintain on inhalant anesthetics. The alternative to this is total IV anesthesia or TIVA. We know that inhalant anesthetics are all powerful cardiovascular and respiratory depressants. We can learn to use TIVA on patients at risk for hypotension under anesthesia, for patients undergoing a short procedure, or even in cases where no vaporizer is available. With this method there is no risk for waste gas pollution. Volatile gas anesthetics do not provide any analgesia and the patient must receive a pre medicant to address pain management whereas drugs used for TIVA have analgesic properties. TIVA does not require any special equipment except a needle and a syringe. Equipment such as a syringe driver or a fluid pump can be used to make a more even anesthetic process.

This technique involves the use of drugs that achieve the elements of the four components of general anesthesia: amnesia (anxiolysis), autonomic areflexia, analgesia, and muscle relaxation. Delivering these drugs as a constant rate of infusion or CRI is preferred over the intermittent IV boluses or IM administration. Intermittent boluses or IM injections will get the job done but a constant plane of anesthesia is more difficult to achieve. The CRI results in fewer sudden hemodynamic changes, lower total amount of drug given, and more rapid recovery from anesthesia due to the ability to change the rate of infusion according to the anesthetic requirement of the patient.

The ideal drug to use for TIVA has a short half life without a cumulative effect, provides adequate anesthetic conditions, minimal CV depression, and is reversible. There is no single drug that has all of these qualities so we must combine drugs. Using this multimodal approach we are able to use smaller quantities of each, thereby decreasing the risk that each carries and additionally gaining the benefits of each drug used.

<u>Propofol</u>

- Advantages
  - Mainstay of TIVA for dogs and humans
  - Can be used for long periods and still have a rapid recovery
- Disadvantages
  - Respiratory depression
  - Lack of analgesia-must be combined with suitable analgesic
    - Fentanyl
    - Ketamine
    - Medatomadine/Dexmedatomadine
  - Not ideal for cats-potential for propofol toxicity with extended use

<u>Alfaxalone</u>

- Suitable for top up and CRI if you get access to it
- Similar to propofol without cardiovascular effects
- Can replace etomidate in high risk patients (etomidate is not ideal as a CRI due to cortisol suppression)

Ketamine

- Can be used as a CRI to add analgesia to less analgesic hypnotics (propofol)
- Provides adjunctive anesthetic effect when used in combination with other anesthetics

Reversible "Anesthesia"

There are three types of reversible agents. None of them produce true anesthesia.

- Opioids (major antagonist naloxone)
- Alpha 2 agonists (antagonist antipamezole)
- Benzodiazepines (antagonist flumazenil)

Combinations of these drugs produce a state that is close to true anesthesia. There are many different combinations that can be used. When reversing the reversible, please consider what you have left. Will it only be ketamine that may require the addition of a benzodiazepine to smooth out the hallucinatory side effects? Have you reversed your analgesia? Have you reversed your opioids? I am very careful in considering when to reverse opioids as this leaves you in the position of not being able to add opioids back for analgesia.

PIVA (MAC reduction)

- Opioids
  - Reduced cardiac output due to bradycardia must be treated.
- Lidocaine
  - Not ideal for cats as it may reduce cardiac output.
- Ketamine
  - Adds analgesia but may cause rough or prolonged recovery.
- Medatomidine
  - Blood pressure is maintained but cardiac output may be decreased due to bradycardia.

CRI Math

One of the most intimidating parts of using a TIVA method is understanding how to titrate it properly. I find that creating a concentration that is easy to use is the key to success. For example, try to make your fentanyl CRI concentration equal to 1mcg/kg/ml. Using this concentration, you can easily titrate the CRI using a syring driver or fluid pump.

Example:

For a 10kg dog you are using a 100ml bag of saline for your CRI. How much drug should you add to how much saline?

- You want your final concentration to be 1 mcg/kg/ml or 10mcg/ml.
- Multiply your micrograms per ml by the number of mls in your bag to get the total number of micrograms you want to have in your bag.
  - Your 100ml bag should contain 1000mcg

- You need 1000mcg so how many mls of drug do you draw up?
    - If your fentanyl is 50mcg/ml:
        - 1000mcg/50mcg/ml=20ml of drug
- Remove 20ml of saline from your CRI bag and replace it with 20ml of fentanyl (50mcg/ml).
- You now have a CRI ready to use!

There are many spreadsheets you can use if you are not confident in your math skills. If you find one you like to use, you can install it on a central computer in your hospital for quick and easy use.

http://www.vasg.org/resources_and_support_material.htm
http://www.aucsoc.com/html/dosage_calculator.html
http://secure.aahanet.org/eweb/images/AAHAnet/phoenix2009proceedings/pdfs/01_scientific/001_ANALGESIA%20DROP%20BY%20DROP.pdf