Delivering TIVA safely

Not let's look at what is taken for granted – or maybe not considered – when setting out to administer a total intravenous anaesthetic (TIVA). The complex anaesthetic machine, simply becomes a device to administer oxygen enriched air; often these days with integrated monitoring and an integrated ventilator.

Try and ensure that whilst not in use, the TIVA pumps are plugged into the mains and switched on to ensure batteries are always fully charged.

Know the pumps you are using – programming, alarms, changing syringes and other available features,for the case.

Try to have a departmental policy on eg, 2% propofol, 50mcg/ml remiconcn and which pump has which drug in (esp in the case of a stack system – Fresenius or Braun). Have an agreed basic settings protocol too – algorithm and target site.

Ensure syringes have luer lock ends and that the delivery tubing is designed for TIVA – they will then incorporate the necessary one way valves and, antisyphon valves to ensure drug delivery to the patient at the rate intended by the programming of the pump. They also have a small mixed drug volume space to promote accurate delivery from the outset.

Don't label remifentanil syringes until the drug has been added to the saline in it.

Make sure, before carefully programming the patient demographics into the pump(s), that you check the correct syringe type is entered onto the pump and that you check the target sites are what you want (effect or plasma) and in the case of propofol, that you have chosen the preferred algorithm for that patient Marsh or Schnider). Different manufacturers have different bores and lengths of syringes of any volume (usually 50 or 60 mls syringes) for TIVA and so the number of millimetres that the plunger is driven will deliver different volumes of drug solution according to the diameter of the syringe barrel. The pump stepper motor essentially works on a mm / hr scale and so the pump needs to know who made the syringe to ensure delivery of the correct amount of drug according to the algorithm chosen and the individual patient demographics.

It is preferable to have a dedicated cannula for the TIVA delivery which should be securely fixed in place and observed frequently if not constantly to check for tissuing or leakage. Modern TCI pumps have both low and high pressure alarms to identify both such phenomena. A 1mm internal diameter should be considered to be the minimum calibre. For safety reasons, consideration could be given to removing this cannula prior to taking the patient to recovery to prevent the bolusing of any drug remaining in the cannula, into the patient. However, this is unlikely to be significant in a 1mm cannula in an adult.

When setting initial targets, remember that you can always give more drug, but you cannot "suck" the drug out! So start levels on the lower side of your expectation and build it (remifentanil) up.

If you choose plasma targeting, you will never get a plasma level above what you have set, so drug equilibration with the peripheral compartments and the effect site will be slower due to a smaller concentration gradient and hence induction will take longer. Plasma

targeting (Schnider is not designed for plasma targeting and attempts to induce patients will be unrewarding at best) is often chosen for ASA 3, 4 or 5 patients who require a more gentle induction. It is therefore not best practice to increase the plasma target temporarily to speed up induction……as this will replicate the peak plasma level (or more) seen when targeting to effect site and hence you will get precisely the pharmacodynamic "hit" that you wish to avoid (principally hypotension) by targeting to plasma in the first place!

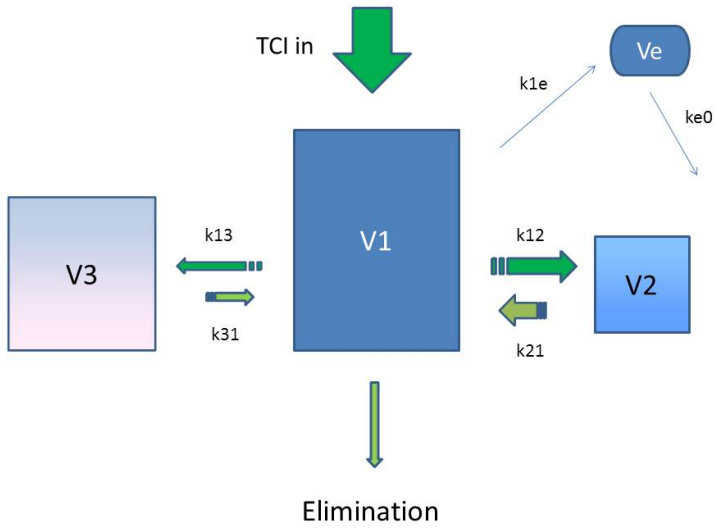
On induction with effect site targeting, pumps give a drug bolus and then switch off until the model predicts that the effect site has reached its chosen target. They then recommence at a rate which maintains this chosen level whilst steady state is reached following vessel rich and vessel poor compartments equilibration via the 3 compartment pharmacokinetic model. When pumps are set to an effect site target of, for example,3 mcg/ml for propofol and 3 ng/ml for remifentanil, peak plasma levels for propofol may reach about 6 mcg / ml and for remifentanil about 11 ng/ml following the initial loading bolus.

Conversely, with plasma targeting, the pumps give a reasonably fast initial infusion, followed by a slower infusion, never causing a high peak plasma level, never bolusing and never switching off after the initial induction infusion. Consequently, when raising the level peroperatively they will still never go above the set plasma level and so the new effect site level will be reached more slowly and hence the depth of anaesthesia increased more slowly.

Some open TCI pumps can have the concentration of drug changed when a syringe is changed over. This is useful when a small amount of 1% propofol may be required for completing wound closure; remember though to alter the pump from 2% to 1% and to still use the same type and size of syringe.

Having changed a syringe, ensure that programming buttons have been pressed to recommence the infusion.

Here again is the diagram of the 3 compartment pharmacokinetic model



NJHugginsFeb 2105