Total Intravenous Anaesthesia

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Abstract:

Total intravenous anaesthesia (TIVA) is a technique of anaesthesia which involves use of intravenous drugs to anaesthetize the patient without the use of inhalational agents. TIVA is getting popular mode of anaesthesia in otolaryngological surgeries. This article reviews the entire procedure of TIVA from otolaryngologist's perspective. TIVA is really useful to anaesthetize patients during functional endoscopic sinus surgeries due to its ability to produce controlled hypotension, and post-operative vomiting free recovery.

Introduction:

TIVA is defined as a technique of general anaesthesia which involves use of intravenous drugs to anaesthetize the patient without the use of inhalational agents. In fact chloral hydrate[1] was the first anaesthetic agent to be introduced intravenously way back in 1870. Introduction of Propofol in 1986 gave a new lease of life to TIVA.

It was Sigismund Elsholtz who first attempted intravenous anaesthesia in 1665 [2]. Real advance in intravenous anaesthesia took place during 1921 when Daniel and Gabriel Bardet published their experiences using somnifaine. Fredet and Perlis combined somnifaine with subcutaneous injection of morphine to supplement the effects of somnifaine. To begin with a Vann's 10 ml syringe was used for this purpose. To facilitate continuous intravenous infusion Abel's syringe [3] was used.

The current popularity of TIVA has been attributed to the pharmacokinetic and pharmacodynamics properties of Propofol and opioids. These drugs are ultra-short acting and hence suitable for continuous infusion. With the advent of advanced computer based drug administration system intravenous drug administration has become safer and predictable. The currently available intravenous drug delivery system allows the anaesthetists of vary the depth of anaesthesia by just controlling the infusion rate of the drug. This is in fact similar to that of conventional inhalational systems currently available.

Advantages of TIVA [4]:

1. Recovery is smooth and predictable
2. No post-operative vomiting
3. There is no pollution
4. Allows high dose of oxygen to be inspired
5. There is virtually no bowel distention
6. Reduced requirement for muscle relaxants
7. Intraocular pressure is reduced
8. Malignant hyperthermia is virtually unknown
9. Controlled hypotension is possible
10. Produces adequate amnesia
11. Produces adequate analgesia
12. Less neuro humoral response

Drug pharmacokinetics:

This is actually the use of mathematics to describe how body handles a certain drug. This is in a nutshell a calculation of the mathematical relationship between the administered dose of drug and the resulting observed changes in its plasma concentration. This is very important in deciding which drug / drug combinations can be safely used to administer TIVA.

Goals of TIVA:

1. Smooth induction
2. Reliable and titratable maintenance of anaesthesia
3. Rapid emergence out of the effects of infused drug as soon as the infusion is terminated

Drug combinations used in TIVA:

1. Propofol with remifentanil
2. Propofol with sufentanil
3. Midazolam with sufentanil [5] (used in patients susceptible to hyperthermia)

Only flip side to TIVA is the expense involved. The newer drugs are highly expensive and coupled with the cost of computerized delivery system adds to the cost.

Target controlled infusion:

This is the basis of TIVA. This system calculates the drug concentration, the delay in the transfer of blood brain barrier. Drugs like Propofol affects its own pharmacokinetics, probably by decreasing cardiac output and also by decreasing hepatic blood flow [4]. Target controlled infusion is performed using a syringe pump.

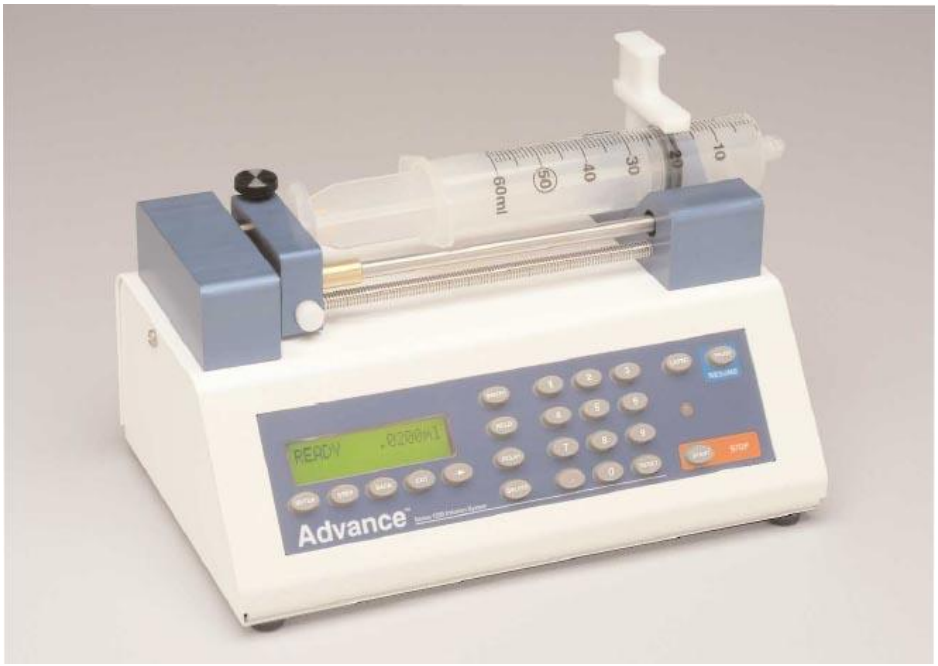

Figure showing syringe pump

Important functions of syringe pump include [7]:

1. Bolus – This gives the ability to rapidly increase plasma concentration of the drug administered
2. Flow rate – The pump should be able to function accurately even at low flow rates
3. Alarms – Facilitates identification of improper positioning of syringe in the pump
4. Tight syringe fitting – This prevents syringe from moving when the pump is in action
5. Battery indicator

Precautions that should be taken while using syringe pump:

1. High concentration of drugs that run at slow speed should be avoided
2. The syringe pump should be connected close to the patient
3. Vasoactive drugs should not be combined with the primary drug
4. Pump should not be placed above the level of the patient

Otolaryngological surgeries where TIVP is preferred:

1. Functional endoscopic sinus surgery [6]
2. Thyroid surgeries where recurrent laryngeal nerve monitoring is needed
3. Advanced endoscopic surgical procedures involving skull base where hypotensive anaesthesia is needed to control bleeding

Propofol:

This drug is GABA receptor agonist. This drug produces deep state of unconsciousness within 30 seconds of administration of loading dose (1.5-2.5 mg/kg body weight). It is also known to cause respiratory depression in 90% of patients. Effects of this drug wanes within 5 minutes of administration due to redistribution of the drug. This drug causes lower incidence of post-operative vomiting. Liver plays a vital role in elimination of Propofol.

Opioids:

Commonly used opioids in TVIP include:

Morphine

Fentanyl – 100 times more potent than morphine

Remifentanyl – Short half life

Sufentanyl – Ultra short half life

Currently only Remifentanyl / Sufentanyl is being used.

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