**Implantable Intrathecal Pump**

In the practice of Pain Management an algorithmic approach with rational progression from simple to more complex therapies is recommended. Advanced pain therapies are to be considered at the end of the spectrum when all simpler therapies fail to relieve severe intractable pain.

Intrathecal pump is an implantable sophisticated device fitted under the skin for continuous pain relief required in the cancer population and also for many non-cancer conditions in the present time.

It is useful for chemical neuromodulation of central nervous system to significantly reduce perception of pain by delivery of the drug. In simple terms, it is a completely internalized system comprising of an intrathecal catheter which is introduced in the fluid containing space around the spinal cord and connected to a drug reservoir sited in a pocket made under the skin. This facilitates administration of a drug directly on the target pain receptors present in spinal cord responsible for pain transmission. The intrathecal administration permits the drug to bypass enteric absorption and/or blood brain barrier hence the dose required is a fraction of systemic dose with improved efficacy and minimized side-effects. For example, dose of morphine from oral to intrathecal route decreases from approximately 300mg to 1mg. The continuous drug delivery ensures a steady drug level in blood, improving quality of analgesia and a miniscule dose required for this purpose also

**Types of Pain and Drugs used:**

The intrathecal pump can be used for nociceptive pain [as predominant in Failed back surgery syndrome], neuropathic pain [as predominant in CRPS] or mixed type of pain [as in cancer]. There are a number of drugs used with the system but three drugs which are at present FDA approved are Morphine, Baclofen and Ziconotide. Ziconotide is good for neuropathic pain but is not available in India yet. A number of other drugs are used as adjuncts for superior analgesia obtained with synergism by different mechanisms. The choice of drug depends on the character of pain and indication and is determined by the clinician after detailed evaluation. The other commonly used drugs are Fentanyl, Bupivacaine and Clonidine. The drug has to be preservative free for use with this device.

**Special Features:**

Intrathecal drug pump is a very sophisticated and programmable system. It involves two stages. First is a trial which is important to determine whether this particular system will suit
that individual or not!! It is like test driving a car before buying. Trial is performed to assess patient’s response to pain control and improvement in side effects. Generally, if patients pain control is >50% better and side effects decreased to >50% of systemic administration of opioids, then patient is a candidate for permanent implantation of intrathecal drug delivery system. After implantation the system is programmed to offer long lasting benefit in terms of satisfactory control of pain.

Intrathecal pump is available in two main types, fixed rate [Isomed] and programmable [Synchromed] pump. Synchromed has two varieties, an older Synchromed El and newer Synchromed II system. Synchromed II has been an improved version and has been more popular due to features such as lighter and flatter implant, increased drug stability to 6 months, improved low reservoir flow accuracy. It comes in two different sizes 20ml and 40ml reservoir capacity. Improved software of Synchromed II stores all patient demographics and notes up to 1000 characters. It also stores catheter information and system log with last 30 events and patient activation log of last 80 events. This information is most useful when technical support is called for help. The information is presented in scrollable window to accommodate more information with multiple drugs. New software allows drug data up to 5 drugs with first drug as a primary drug. A personal therapy manager (PTM) is a compact handheld remote control like device to enable patient to take extra boluses if required for the incidental or breakthrough pain. This gives a better degree of patient satisfaction.

**Implantation Technique:**

The implantation is performed in OT using fluoroscopic guidance and all surgical asepsis. The two piece silicone catheter is introduced through a special introducer needle and guided into subarachnoid space up to the desired level depending on pain geography and property of the drug used. It is secured to thoracolumbar fascia with special anchor, tunnelled in subcutaneous plane and connected to the Synchromed pump by suture less connector on the proximal piece of the catheter. The pump is emptied of its manufacturing fluid and filled with the desired drug before implanting in the subcutaneous pocket. Both the incisions are surgically sutured neatly after adequate haemostasis.

**Exclusion Criteria:**

- Tumor encroachment of the thecal sac
- Intracranial process that may lead to cerebellar herniation in the setting of cerebral spinal fluid leak
- Implant not feasible <2.5 cm from skin
- Coagulopathy, emaciation
- Morbid psychiatric conditions
- Local or Systemic infection

**Disadvantages and Complications:**

The main drawback of using this system being used more widely especially in our country is the cost. There should be reasonable life expectancy [at least three months] before consideration of implanting this device. Assessments of cost-effectiveness suggest that cost savings are achieved after 2 years in comparison to systemic pharmacologic therapy for chronic, non-cancer pain.¹

Complications related to intrathecal therapy are rare in hands of experts familiar with this technique but if occur, can be technical, biological, or medication related. While the vast majority of complications are minor, some serious complications can occur include Granuloma formation that may be related to the amount and concentration of opiates, mostly with high concentrations of Morphine and Hydromorphone.

It is important to realise that clinician skills and expertise is vital for both initial implantation as well as for programming as errors can be potentially lethal.

**Maintenance and Follow up:**

It is said that implanting a pump is like a marriage between the patient and the clinician as it requires ongoing monitoring and maintenance. A follow up at regular intervals [average every three months] is essential for refill of the drug in the pump reservoir and titration of the dose or drug to achieve the best possible analgesia. The battery of the pump requires surgical replacement about every 5-7 years depending on the flow rate used.
Conclusion:

Intrathecal pump is a useful interventional option for patients suffering from cancer and non-cancer pain refractory to other simpler modalities. It provides continued and accurate analgesia in patients requiring round the clock pain relief. The success of the therapy depends on proper selection of the patient and expertise on part of the clinician. It warrants good coordination between the clinician and patient as it regular titration is the key for optimum benefit.