Anesthetic considerations for patients with implanted devices for treating chronic pain and more

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Objectives:

1- learning about implantable devices for treating chronic pain

2- Anesthetic precautions in patients with implanted devices.
Peripheral nerve stimulation

spinal cord stimulation (SCS) has become increasingly important in the management of chronic pain conditions including chronic back and leg pain, CRPS, cardiovascular conditions, peripheral neuropathy, peripheral vascular disease and more

Common indications:
Failed back surgical syndrome
CRPS
Low back pain with radicular pain

Mechanism of action:
Gate theory and others.
Criteria for implant:
1. Failure of conservative management.
2. SCS trial.
3. SCS implant.

Intraoperative:
Device should be reprogrammed to the lowest possible amplitude and then turned off prior induction of anesthesia.

Effect on EKG
Interpretation can be affected by artifact which can occur due to body movement or implanted electric devices. SCS can interfere with EKG reading resulting in high frequency artifacts. Those artifacts will not occur if the SCS is inactive.
Interaction with electrocautery:

It is recommended to use bipolar but in some cases, it is still necessary to use monopolar electrocautery.

Use the lowest temperature for the shortest duration possible.

the grounding pad should be placed as far away as possible from the SCS and on the contralateral side of the battery.

The device should be interrogated after surgery to ensure system integrity and normal impedances.

Ultrasound and Lithotripsy:

Recommendation is that patients with SCS should not go for Ultrasound or Lithotripsy therapy. But if have to undergo this treatment, turn off device during procedure, avoiding focus of the Lithotripsy beam within 15 cm of the SCS, and ensuring functionality at the end of the procedure by powering up the device and then slowly increasing stimulation.

Interaction with Pacemaker and Defibrillators:

There is risk of sensing stimulation from the SCS which can lead to suppressing of pacing function or inappropriate defibrillation that is why their concomitant use is not recommended.
If based on risk and benefit the decision is to use SCS in the presence of pacemakers or defibrillators, testing during trial is important. Testing is done by increasing the stimulation of SCS to maximum tolerated and increase sensing of the device to maximum and watch for any interaction.

In emergency situations, the first consideration is patient survival. External defibrillation and cardioversion can damage the device or induce electrical current in the wire. This is minimized by placing paddles away from the SCS, placing paddles perpendicular to the SCS, and use of the lowest energy appropriate.

**Neuroaxial anesthesia:**

Epidural and spinal anesthesia is not contraindicated but has to be performed with caution.

Consider the location of the leads.

Efficacy of epidural medications may be reduced due to decreased spread in the epidural space where the SCS leads exist.
MRI

It is essential to know the device model and manufacturer. Some devices are MRI compatible and some are not.

MRI compatible devices can be compatible only for certain parts of the body and/or certain doses only.

Device should be interrogated after MRI to ensure system integrity.

CT

Turn off device during procedure
Use the lowest possible dose.
Avoid excessive scanning at the battery site.
Interrogate after scan.

Intrathecal pump
Understanding the Device

IDDS was introduced in 2004. This consists of a metal housing that holds a bellow containing the drug. The bellow is surrounded by pressurized gas which exerts pressure on both the bellow and the drug. Drug delivery is achieved with a battery-powered peristaltic pump.
Hydromorphone, Fentanyl, Clonidine, Bupivacaine?

Pre-procedure Planning

The care team should determine the age of the device, the last time the pump was evaluated, current pump medication and dose, and when the patient is due for a refill or a pump change.

The majority of pumps are designed to last 5-7 years, and are refilled approximately every 1 to 6 months. The interval for refills and device changes depend on the drug delivery rate and reservoir volume.

It is important to review the manufacturer’s guidelines for the specific device used, when known.

Intraoperative Pain Control

For a patient already receiving intrathecal opioids at baseline, the addition of procedure-related opioids may induce unwanted respiratory depression.

If the patient is receiving intrathecal baclofen at baseline, addition of opioids may have a greater-than-expected response due to the synergistic nature of the drugs.

Unfortunately there is no reliable way to convert intrathecal opioid dosing to an intravenous equivalent dosing, or to predict the degree of increased sensitivity due to baclofen. Estimates for an equianalgesic dose of oral to intrathecal morphine range from 12:1 to 300:1.
Patient Positioning and Surgical Site

Consider pump location when you position the patient.

Care should be taken to avoid positions including twisting, excessive bending, or stretching that might kink, occlude, dislodge, or damage the catheter.

Impact of Temperature on Device Function

It is imperative to monitor the patient’s temperature and ensure that the device is not subject to significant temperature fluctuations. When the patient’s temperature increases, the pump’s temperature may be impacted, which can increase the drug delivery rate and contribute to overdose. Manufacturer recommendations state that the patient’s body temperature should not exceed 39 °C to minimize risk of alterations in pump dosing.

A lower limit is not noted, however the patient should be maintained within a normal physiologic range, as a low temperature would have the potential to decrease the rate of drug delivery. This may lead to decreased efficacy of the pump, leading to reemergence of the symptoms for which the pump was implanted, and potentially even precipitate withdrawal.
MRI

MRI is not contraindicated in the presence of a pump, but does require special consideration. A device that is designated as "MRI conditional" is one that may, under the appropriate circumstances, safely be subjected to the magnetic field of an MRI scanner.

While it is technically feasible to obtain an MRI, it is important to remember that the presence of the device itself may distort the MRI image, especially in the immediate vicinity surrounding the pump.

Prior to obtaining an MRI it is important to determine whether drug delivery can safely be suspended during the scan. The magnetic field of an MRI scanner temporarily suspends programmable pumps, pausing drug delivery, and restarting once MRI exposure has ended.

Approximately 20 minutes after completion of the scan, the device should be interrogated to ensure that it restarted automatically, and special attention should be paid to those receiving baclofen, as withdrawal can be life-threatening.

Defibrillation and Cardioversion

The first concern must always be patient survival, even in the presence of an intrathecal pump. If defibrillation is performed, the pads should be placed in an effort to keep the path of the current as far away from the pump as possible.

Manufacturer testing indicates that defibrillation is unlikely to damage the device, however the device should be interrogated to ensure appropriate functioning if defibrillation is performed.
Diathermy

Presence of a pump is not an absolute contraindication to diathermy. The primary concern, highlighted by the manufacturer, is the risk of device heating, which may alter pump temperature, and therefore pump infusion rate. Shortwave diathermy is not recommended for use within 30 cm of the pump or catheter for this reason, and the effects of other types of diathermy such as microwave or ultrasound are untested.

Electroconvulsive therapy (ECT)

The safety of ECT among patients with IDDS has not been established, however it is believed that it may cause alterations in pump operation and flow rate.

Published case reports showed no complications.

Radiation Therapy

Radiation therapy can cause permanent damage to the pump, and as such should be used with caution.

While it is not encouraged by the manufacturer, at least one study has published results of 39 patients who received 60 separate courses of external beam radiation therapy with cumulative radiation doses from 5 to 36 Gy to the pump and 15 to 45 Gy on the catheter, with beam energies that ranged from 6 to 18 MeV photons. No pump malfunction.

Consider shielding the pump.
Ablation

Radiofrequency and microwave ablation in the presence of an intrathecal pump are not well documented, and their safety is not established.

The primary concern is that induced electrical currents may cause pump heating that could result in a clinically significant overdose.

THANK YOU

QUESTIONS

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