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Minimal Opioid Anesthetic In Patient With History Of Substance Abuse: A Case Study

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More than half of the population in the United States of America drinks alcohol regularly.[1] Thousands of deaths annually are linked to drug overdoses, and that number continues to rise. Anesthesia professionals can expect to see patients in various levels of substance abuse, and recovery, during their practice. This case study is presented to discuss a minimal narcotic technique given in a patient with a history of prescription drug abuse, who had been substance free since successfully been through a recovery program years prior.

Case Report

45 year old female, weighing 79.5kg presenting for a mastopexy and adbominoplasty. No significant medical or surgical history other than recovery from abuse of prescription medications. The patient requested to minimize potentially addictive medications. Prior to the day of surgery an alternative anesthesia plan was agreed upon by all parties involved.

On the day of surgery, informed consent was signed for general anesthesia with endotracheal intubation. 3mg midazolam was administered intravenously (IV) in the pre-operative holding area. Once in the operating room, standard non-invasive monitors were applied, and oxygen was administered at 10L/min via face mask. 1mg of additional midazolam IV was administered, and an infusion of 1000mg IV acetaminophen started. A 4gm infusion of magnesium sulfate IV was also given, and 20mg esmolol IV was titrated to control heart rate prior to endotracheal intubation. After 3 minutes of preoxygenation, the patient was induced with 80mg IV lidocinane, 120mg IV propofol, 30mg IV ketamine, and 40mg IV rocuronium. A size 7 endotracheal tube was place using a miller 3 for a direct laryngoscopy, with a grade 1 laryngoscopy view. Bilateral breath sounds were auscultated, and the endotracheal tube was secured. The patient was easily ventilated with pressure control mode of ventilation. 12mg IV dexamethasone was administered, as well as additional boluses of 10mg IV esmolol when the patient's heart rate and blood pressure increased and sustained by greater than 10 points above baseline.

General anesthesia was maintained at 2% sevoflorane inspired concentration, with a mixture of 0.5L/min of oxygen and 1.5L/min of air. The patient was positioned supine, with the head of the bed elevated 20 degrees, and the surgery was started. Narcotics were avoided throughout the maintenance period of the case, with continued administration of 10mg IV esmolol at parameters

listed above. Additional 10mg doses of IV ketamine were also administered to a total of 100mg. 80mg of IV lidocaine was added to the IV fluids an hour after induction. Prior to emergence, ondansetron 4mg was given for nausea prophylaxis, and 30mg IV ketorolac for pain control. The only narcotic used was 0.5mg hydromorphone given prior to extubation. Total surgery and anesthesia time was 328 minutes.

Postoperatively, the patient remained stable, with no complications. An additional 1000mg IV acetaminophen was given in the post anesthesia care unit, but no other medications were required before the patients discharge. The patent remained pleased with the anesthesia care and alternative pain control on follow up assessment.

Discussion

The mechanisms of surgery activate the nociceptors, causing mainly somatic pain. This type of pain is very localized and sharp in nature. Patients may have other types of baseline pain that an anesthesia professional must also work to alleviate during the surgery. The noxious stimuli caused by the physical mechanisms of surgery triggers a biochemical response, which includes the release of the neurotransmitters bradykinin, serotonin, and substance P. Together these substances generate an action potential, which is transduced into an electrical energy. This then causes electrical signals to be transmitted to the central nervous system (CNS), so the signal can be perceived by the brain.[2]

Opioids are a well-accepted part of most anesthesia plans, providing pain relief from the noxious stimuli of surgery. These drugs work by binding mostly to opiate receptors in the CNS, though there is evidence that there may be some peripheral sites as well. Supraspinal opioid receptors work by increasing the movement of potassium ions, which inhibits the pain pathway[2]. While the use of opioids has an undeniable place in surgical pain control, universal administration of high dose opioids may not always be in the patient's best interest. Millions of Americans are using opioids for non-medical use, or recovering from the non-medical abuse of opioids. There are, however, a growing number of alternative analgesics available that can be used in a multimodal fashion to minimize, or even eliminate the need for narcotics.

Nonsteroidal anti-inflammatory drugs (NSAIDs) and acetaminophen are a well-established method for the management of mild to moderate pain, especially when the pain is the result of inflammation. These medications work by inhibiting the action of cyclooxygenase. This prevents the conversion of arachidonic acid to prostaglandins, which in turn limits how sensitized peripheral nociceptors are to inflammatory mediators.[2] Meta-analysis also shows that administering acetaminophen in conjunction with an NSAID has combined effects over the use of each drug separately.[3]

Located throughout the brain and spinal cord are N-methyl-D-aspartate (NMDA) receptors. The excitatory neurotransmitter glutamate binds to this receptor, which continues the transmission of painful stimuli impulses to the CNS, and it is thought that antagonization of these receptors can

prevent hyeperalgesia of the CNS.[2,4] Two drugs that can achieve this are magnesium sulfate and ketamine. Magnesium is a non-competitive NMDA receptor antagonist, which inhibits the influx of intracellular calcium, and has been show to lower postoperative analgesia requirements. Ketamine works on a different NMDA receptor site, and their use together may have an additive effect on analgesia, even when lower doses of both are administered. Studies have shown that patients who receive intraoperative magnesium and ketamine have a lower opioid consumption[4].

Lidocaine is a commonly used local anesthetic, which works by blocking sodium channels and may also work on the NMDA receptors. These effects have been reported to reduce postoperative pain, which can reduce opioid consumption. Studies have been done, giving a bolus of lidocaine, followed by an infusion, showing that there was a reduction in postoperative analgesia requirements.[5]

The glucocorticosteroid, dexamethasone, is often used as an antiemetic. A meta-analysis has shown that a dose of 0.1mg/kg or higher can reduce posoperative pain, resulting in a lower narcotic requirement. Steroids have a known anti-inflammatory effect, which can aid in blocking the electrical stimuli of surgical trauma being conducted to the nervous system.[3, 6]

Opioid induced hyperalgesia, is a documented occurrence. With this theory, the narcotics given during surgery can cause a hyperalgesia in the postoperative phase. Pain causes a catecholamine response in the body, which results in an increased blood pressure and heart rate. These signs can be seen intraoperatively, and are normally treated with opioids.[7] Esmolol has been used intraoperatively, most often as an infusion. Studies show it has decreased the overall requirement for anesthesia as well as narcotics. There was a decreased level of postoperative pain reported, requiring lower levels of analgesics.[8]

Substance abuse is a serious problem that many people face, and can complicate the surgical course of anesthesia. A multimodal approach to analgesia can offer an alternative to traditional narcotic pain control, giving specific patient populations, such as those in recovering from substance abuse, a better postoperative outcome.

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Substance abuse, whether alcohol, illicit drugs, or non-medical use of prescription medications has become an epidemic in the United States of America. According to the CDC, more than half of the population drinks alcohol regularly. Drug use continues to rise, and causes thousands of deaths every year (CDC, 2015). The problem is not only with those who are currently abusing a substance, but also those struggling to remain in recovery. A 2014 study reported that addicts who self-referred to a treatment center had a relapse rate of greater than 60%. High risk situations put this population at an even greater risk for relapse. The study found that the situations most likely to cause a patient to turn back to substance abuse were physical discomfort and unpleasant emotions, such as anxiety. These two particular high risk situations can both of these can be associated with surgery. The perioperative period exposes these patients to these high risk factors. Then a substance commonly abused substance, narcotics, are administered intaoperatively, as well as postoperatively which continues into the patients discharge with a prescription (Shafiei, et al, 2014). While any substance abuse, current or past, can dramatically change an anesthesia professional's patient care. Now there are many options now to minimize the narcotic use, with the hope of helping to minimize the chance of relapse in the patient who has had successful treatment for their addition.

Physical pain, a common trigger for drug relapse, is a component of all surgeries. Surgical pain control is critical roles of the anesthesia professional. Somatic pain, which is sharp and localized in nature, is commonly associated with surgery. Visceral pain is another pain that can be associated with surgery, depending on the type of surgery being performed. This is a pain caused by the distention of an organ capsule. Surgical pain is caused by the activation of nociceptors by the physical trauma of the surgery. Patients may have other types of baseline

pain, such as neuropathic, which is the abnormal processing of pain sensation. An anesthesia professional may also need to alleviate this underlying pain during the surgery in addition to surgical pain further complicating the plan of care. For pain to be sensed by the body, the noxious stimuli caused by the physical mechanisms of surgery triggers a biochemical response, which includes the release of the neurotransmitters bradykinin, serotonin, and substance P. Together these substances generate an action potential, which is transduced into an electrical energy. This then causes electrical signals to be transmitted to the CNS, so the signal can be perceived by the brain (Nagelhout & Plaus, 2010).

Opioids are a well-accepted part of most anesthesia plans, providing pain relief from the noxious stimuli of surgery. These drugs work by binding mostly to opiate receptors in the central nervous system, though there is evidence that there may be some peripheral sites as well. Supraspinal opioid receptors work by increasing the movement of potassium ions, which inhibits the pain pathway (Nagelhout & Plaus, 2010). While the use of opioids has an undeniable place in surgical pain control, universal administration of high dose opioids may not always be in the patient's best interest. Millions of Americans are using opioids for non-medical use, or recovering from the non-medical abuse of opioids. However, there are a growing number of alternative analgesics available that can be used in a multimodal fashion to minimize, or even eliminate the need for narcotics (Gritsenko, et all, 2014).

Nonsteroidal anti-inflammatory drugs (NSAIDs) and acetaminophen are a well-established method for the management of mild to moderate pain, especially when the pain is the result of inflammation. There oral over-the-counter forms make them familiar, inexpensive, and easily accessible by patients. The role of the common medications does not have to stop when the patient enters the surgical suite, as they can be part of the multimodal treatment to minimize

narcotic use both intraoperative and postoperatively. These medications work by inhibiting the action of cyclooxygenase. This prevents the conversion of arachidonic acid to prostaglandins, which in turn limits how sensitized peripheral nociceptors are to inflammatory mediators (Nagelhout & Plaus, 2010). Ketorlac is a frequently used, and potent, NSAID during the operative time period due to its ability to be administered intravenously. Acetaminophen is also available in an intravenous (IV) form, and is a centrally acting analgesic. The exact mechanism is unknown, but it is thought to inhibit central prostaglandin synthesis similarly to NSAIDs, and elevate the pain threshold (Herring, et all, 2014). These two medications are also metabolized differently in the body, as acetaminophen utilizes a hepatic route, where NSAID's are cleared from the body using the renal system. This allows them to be administered within close proximity to each other, without the risk of patient harm from overdosing. Meta-analysis also shows that administering acetaminophen in conjunction with an NSAID has combined effects over the use of each drug separately (Zukowski, & Kotfis, 2012), providing the patient with an improved level of pain control.

Another group of commonly used medications in the operative situation are N-methyl-D-aspartate (NMDA) antagonists. Located throughout the brain and spinal cord are NMDA receptors. The excitatory neurotransmitter glutamate binds to this receptor, which continues the transmission of painful stimuli impulses to the CNS, and it is thought that antagonization of these receptors can prevent hyeperalgesia of the CNS (Nagelhout & Plaus, 2010) Two drugs that can antagonize this receptor, and achieve this are magnesium sulfate and ketamine. Ketamine is an already well established drug in anesthesia practice. It is known for its analgesic properties as well as its anesthetic ones. Many studies have demonstrated the ability of ketamine to reduce perioperative opioid requirements (Zukowski, & Kotfis, 2012). One study even showed its

effectiveness in decreasing opioid consumption in patients who had opioid tolerance (Loftus, 2014), possibly making it even more useful in situations where patients have a history of chronic substance abuse. Magnesium is a non-competitive NMDA receptor antagonist that works on a different NMDA receptor site than ketamine, which inhibits the influx of intracellular calcium, and has been shown to lower postoperative analgesia requirements. A study monitoring postoperative pain in patients having non-laproscopic abdominal surgery showed a significant reduction in severe pain after an infusion of magnesium. These two drugs can be given together, and studies have shown that patients who receive intraoperative magnesium and ketamine have a lower opioid consumption (Jabbouar, et all, 2014).

Lidocaine is a commonly used local anesthetic, which works by blocking sodium channels, and may also work on the NMDA receptors. Most commonly, it is used as an injection near a nerve or by local infiltration by a surgeon, which can successfully decrease a patient's pain level by blocking pain transmission. It can also be administered systemically by an intravenous infusion, which has been researched as a way to reduce a patient's pain, therefore decreasing narcotic requirement (Gritsenko, et all, 2014). While some studies have shown that low dose lidocaine has a very limited effect on a patient's postoperative pain level (Choi, et all, 2012), there are studies where doses of lidocaine have shown to reduce postoperative pain, and opioid consumption. Studies have been done, giving a bolus of lidocaine, followed by an infusion, showing that there was a reduction in postoperative analgesia requirements (Yon, et all, 2014).

The glucocorticosteroid, dexamethasone, is often used as an antiemetic intraoperatively, but it has proven to be useful for relieving postoperative pain, too. A dose of 8mg has been shown to help reduce pain level (Zukowski, & Kotfis, 2012). Also a meta-analysis has shown

that a dose of 0.1mg/kg or higher can reduce postoperative pain, resulting a lower narcotic requirement (De Oliveira, et all, 2011). A random, double blind study tested increasing the dose from 8mg to 40mg, but did now show any significant change in postoperative pain. Steroids have a known anti-inflammatory effect, which can aid in blocking the electrical stimuli of surgical trauma being conducted to the nervous system (Zukowski, & Kotfis, 2012).

Pain causes a catecholamine response in the body, which results in an increased blood pressure and heart rate. Opioids are a well-accepted method to decrease this response by reducing the patient's sensed pain. There are many side effects from the use of opioids, both from short term and long term use. One of these side effects that can be seen, even from intraoperative narcotic use, is opioid induced hyperalgesia, which can be seen in the postoperative phase. Studies have been showing that the use of the short acting beta adrenergic blocker, esmolol, can be used to control the sympathetic response to pain, and can actually reduce the postoperative opioid requirement (Lóp ez-Álvarez, et all, 2012). The use of esmolol for this purpose intraoperatively has commonly been as an infusion. In studies done, it has decreased the overall requirement for narcotics, both intraoperatively and postoperatively (Celebi, Cizmeci, & Canbay, 2014). These findings were consistent, even when compared to a group that received remifentinil and ketamine intraoperatively (López-Álvarez, et all 2012).

The alternatives to a classic opioid anesthetic technique continue to grow, as does the research behind them. A multimodal approach can treat a patient's pain at various pathways and receptors to provide consistent pain control for patients who may have a challenged postoperative course as a result from a history of drug abuse. Substance abuse is a serious problem many people face, and can complicate the surgical course of anesthesia. Utilizing this multimodal and opioid sparing approach can present this specific patient population with the

possibility of a better postoperative outcome by reducing their requirement for opioids, while still providing adequate pain control.

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