



Dexamethasone as an Adjuvant to Lidocaine 2% and Levobupivacaine 0,5% in Transversus Abdominis Plane (TAP) Block after Appendectomy Surgery: A Case Report

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ABSTRACT

Introduction: Post-appendectomy pain can hinder patient recovery and increase opioid consumption. TAP (transversus abdominis plane) block is an effective regional anesthetic technique for controlling pain after abdominal surgery. Dexamethasone, as an anti-inflammatory, can be added as an adjuvant to enhance the analgesic effect. **Case presentation:** This study describes the effectiveness of TAP block with adjuvant dexamethasone in patient A, a 17-year-old woman who underwent appendectomy. The patient received a TAP block with lidocaine 20 ml, levobupivacaine 10 ml, and dexamethasone 10 mg. Patient pain was measured using the numeric rating scale (NRS) at 1, 2, 6, 12, and 24 hours after surgery. Patients experienced low NRS values, even 0 at 1, 2, 6, 12, and 24 hours after surgery. Adjuvant dexamethasone to TAP block likely increases the analgesic effect and reduces opioid requirements. **Conclusion:** TAP block with adjuvant dexamethasone is an effective regional anesthesia technique for controlling post-appendectomy pain, increasing patient comfort, and speeding recovery.

1. Introduction

Appendectomy, or surgical removal of the appendix, is a surgical procedure commonly performed to treat appendicitis, namely inflammation of the appendix. Even though it is considered a minor operation, appendectomy is often accompanied by significant post-operative pain complications. This pain can be acute, sharp, and persistent, and can interfere with comfort, hinder recovery, prolong hospital stays, and increase opioid consumption. Pain after appendectomy surgery not only affects the individual patient, but also has wider consequences for the health system. Excessive opioid consumption related to postoperative pain can lead to addiction, overdose, and death. Additionally, uncontrolled pain

can increase the risk of complications such as wound infection, paralytic ileus, and deep vein thromboembolism. Therefore, controlling pain after appendectomy surgery effectively becomes an urgent need to improve patient quality of life and minimize the burden on the health system.¹⁻³

Various anesthetic techniques have been developed to control pain after appendectomy surgery, including systemic analgesia (oral or intravenous pain relievers), epidural anesthesia, and regional anesthesia. Regional anesthesia, such as the TAP (transversus abdominis plane) block, has shown promising effectiveness in controlling post-appendectomy pain with several advantages over other methods. TAP block is a regional anesthetic technique that blocks the

transversus abdominis intercostal nerve (T7-T12), which innervates the anterior abdominal wall and abdominal viscera. This technique is performed by injecting a local anesthetic between the transversus abdominis and rectus abdominis muscles, producing effective analgesia in the area affected by surgery. TAP blocks provide localized analgesia to the surgical area, thereby minimizing systemic side effects such as nausea, vomiting, and dizziness. TAP blocks can provide more potent and long-lasting analgesia than systemic analgesia, thereby reducing the need for opioids. Effective pain control can help patients move more comfortably, increase appetite, and speed up mobilization, thereby shortening hospital stays. TAP blocks can help reduce postoperative opioid consumption, which can minimize the risk of addiction and opioid-related side effects.⁴⁻⁶

The analgesic effect of TAP block can be maximized by adding dexamethasone as an adjuvant. Dexamethasone, a synthetic glucocorticoid, has anti-inflammatory and immunomodulatory effects that may help reduce inflammation and sensitization of nociceptors in the surgical area, which are major factors contributing to postoperative pain. The anti-inflammatory effects of dexamethasone help reduce the production of inflammatory mediators, such as prostaglandins and leukotrienes, which can increase the sensitivity of nociceptors and amplify pain signals. Dexamethasone can also inhibit the migration of inflammatory cells to the surgical area, which further helps reduce inflammation and pain. Apart from anti-inflammatory effects, dexamethasone also has an immunomodulatory effect which can help reduce nociceptor sensitivity. Dexamethasone can reduce the expression of pain receptors (TRPV1 and TRPV4) in nociceptors, thereby reducing nociceptor activation and pain signal transmission. Dexamethasone can also increase the release of endorphins, endogenous neurotransmitters that have analgesic effects. The combined anti-inflammatory and immunomodulatory effects of dexamethasone may enhance the analgesic effect of TAP block and prolong the duration of analgesia. This can help reduce the need for postoperative opioid analgesics, which can improve

patient comfort, speed recovery, and reduce the risk of opioid addiction and drug side effects.^{7,8}

2. Case Presentation

A 17-year-old woman has been experiencing right lower abdominal pain for two days before coming to the emergency room. Initially, she had epigastric pain, then the next day it shifted to the right lower abdomen. She also complains of fever, nausea, and vomiting. She states that she had her period one week ago, consistent with her menstrual cycle. There is no history of other systemic diseases such as hypertension, diabetes mellitus, asthma, and history of drug allergies. Her BMI is 20.0. On physical examination, there is tenderness and rebound tenderness in the right lower quadrant (McBurney's point). Laboratory tests show leukocytosis (15,000) and a negative pregnancy test. The patient is diagnosed with appendicitis by a general surgeon and scheduled for an appendectomy. The patient is classified as ASA (American Society of Anesthesiologists) 1 based on physical status. The patient is planned to undergo Regional Anesthesia using a spinal block and postoperative management utilizing the TAP (trans abdominis plane) block technique.

The patient's vital signs before anesthesia administration were: blood pressure (BP) 112/63 mmHg, heart rate (HR) 76 beats per minute, oxygen saturation (SpO₂) 99%, and respiratory rate (RR) 14 breaths per minute. Oxygenation was provided via nasal cannula at 2 liters per minute. The patient was given 20 ml/kg prophylactic crystalloid fluid and was administered intravenous 4 mg of Ondansetron followed by spinal anesthesia. The patient was placed in a lateral decubitus position, after the patient was draped, spinal anesthesia was administered using 0.5% of Bupivacaine at L3-L4 level. After anesthesia administration, pain stimulation was conducted at the operative site, and the patient was asked to lift both legs to ensure complete blockade. The vital signs after regional anesthesia were as follows: blood pressure (BP) 93/60 mmHg, heart rate (HR) 65 beats per minute, respiratory rate (RR) 16 breaths per minute, and oxygen saturation (SpO₂) 100%. The patient's vital

signs were monitored every 5 minutes, followed by a recording of fluid intake and any bleeding that occurred. During the surgery, 450 cc of fluid entered and there was 150 cc of bleeding.

After the surgery, acute pain management was conducted using a TAP block. Preparation for the TAP block included: Levobupivacaine 0.5% (volume: 10 cc), Lidocaine 2% (volume: 8 cc), and Dexamethasone 10 mg (volume: 2 cc) and 100 mm 22G Stimuplex needle also 10 cc of 0.9% normal saline for priming and flush the remaining drug. The vital signs before induction of TAP block are blood pressure (BP) 112/78 mmHg, heart rate (HR) 68 beats per minute, respiratory rate (RR) 16 breaths per minute, and oxygen saturation (SpO₂) 100%. After draping the patient, the entry site for the TAP block needle was located between the iliac crest and the costal margin. The ultrasound probe was placed transversely on the skin to visualize the external oblique muscle, internal oblique muscle, and transversus abdominis muscle. Using the plane technique, the needle tip was positioned in the space between the internal oblique muscle and the transversus abdominis muscle. After ensuring that the needle is positioned in the intended fascia, aspiration is performed first to ensure that the needle does not enter blood vessels. Then, an initial injection is administered by giving 3 cc of normal saline 0.9%, and

the fluid is confirmed to enter when a hypoechogenic appearance is observed on ultrasound. Subsequently, the Levobupivacaine + Lidocaine + Dexamethasone medication is injected. A hypoechogenic appearance is observed on ultrasound, and the fascia appears "open" due to the administration of the medication. After the drug injection, another 3 cc of normal saline 0.9% is given as a "flush" to clear any remaining medication that may still be in the Stimuplex catheter. After completion, the needle is withdrawn, and pressure is applied to the injection site for 30 seconds to ensure there is no bleeding. Paracetamol 500 mg is also administered orally every 6 hours, and ibuprofen 400 mg is given intravenously every 8 hours. The observations we made after administering the TAP block included assessing the patient's numeric rating scale (NRS) pain scores at 1 hour, 2 hours, 6 hours, 12 hours, and 24 hours postoperatively. Additionally, we also monitored the physical activities that the patient could perform after the surgery and recorded any requests for postoperative opioid use. To assess the NRS, we first explained to the patient how to evaluate pain. A score of 0 indicates no pain at all, a score of 5 indicates moderate pain and a score of 10 represents the most severe pain ever experienced by the patient in their lifetime.

Table 1. Observation of NRS scale during 1 hour, 2 hours, 6 hours, 12 hours, and 24 hours post appendectomy.

Time (postoperative)	NRS
1 hour	0
2 hours	1
6 hours	0
12 hours	0
24 hours	0

In the first hour, the patient reported a pain scale rating of around 0 at the surgical site. The patient was unable to move their feet and could not turn to the right or left. The patient did not request additional acute pain relief medication. In the subsequent 2 hours, the patient reported a slight increase in pain, with a rating of approximately 1. The patient began to perform flexion movements with their feet and did not request additional acute pain relief medication. At 6 hours postoperatively, the patient had returned to their room. The reported pain scale ranged around 0,

and the patient was able to flex their feet and knees. The patient did not request additional medication for acute pain relief. Twelve hours later, the patient reported a pain scale rating of 0 at the surgical site. The patient could turn to the right and left, and sit on the bed, but was still unable to walk. There were no requests for additional medication for acute pain relief. 24 hours after, the patient said no pain at all at the surgical site, and could move from the bed, and able to walk.

3. Discussion

TAP (transversus abdominis plane) block with adjuvant dexamethasone has demonstrated effectiveness in controlling post-appendectomy pain, as demonstrated in this case report. Patients receiving TAP block with adjuvant dexamethasone experienced low NRS (numeric rating scale) scores and did not require additional opioid analgesics. This effectiveness can be explained through a deeper understanding of the mechanism of action of the combination of TAP block and adjuvant dexamethasone in modulating pain after appendectomy surgery. The TAP block blocks the transversus abdominis intercostal nerve (T7-T12), which provides analgesia to the anterior abdominal wall and abdominal viscera. The local anesthetics used in TAP block, such as lidocaine and levobupivacaine, work by blocking sodium channels in nerve fibers, thereby preventing the transmission of pain signals to the brain. Dexamethasone, a synthetic glucocorticoid, has anti-inflammatory and immunomodulatory effects that contribute to its analgesic effect.⁹

Dexamethasone, a synthetic glucocorticoid, has anti-inflammatory effects which play an important role in enhancing the analgesic effect of TAP block in controlling pain after appendectomy surgery. The anti-inflammatory mechanism of dexamethasone involves various biological processes that inhibit the production and activity of inflammatory mediators, such as prostaglandins and leukotrienes, which ultimately reduce the sensitivity of nociceptors and the transmission of pain signals. Dexamethasone inhibits the activity of the enzyme cyclooxygenase (COX), which is responsible for the conversion of arachidonic acid to prostaglandins and leukotrienes. Prostaglandins and leukotrienes are potent inflammatory mediators involved in a variety of inflammatory processes, including pain, vasodilation, vascular permeability, and smooth muscle contraction. Dexamethasone works by binding to the glucocorticoid receptor (GR) which is found on various cells, including inflammatory cells. Activation of GR by dexamethasone induces various anti-inflammatory effects, including inhibition of COX activity. There are two main COX isoforms: COX-1 and COX-2. COX-1 is

constitutively expressed in various tissues and plays a role in physiological functions, such as the regulation of platelet aggregation and renal function. COX-2 is induced by various inflammatory stimuli, such as lipopolysaccharide (LPS) and tumor necrosis factor (TNF- α), and plays a role in acute inflammatory processes. Dexamethasone inhibits both COX-1 and COX-2 activity, although its effects are stronger on COX-2. Inhibition of COX-2 by dexamethasone is more relevant in the context of post-appendectomy pain, as COX-2 is significantly induced in the surgical site in response to trauma and inflammation. Inhibition of COX by dexamethasone directly reduces prostaglandin and leukotriene production. Prostaglandins increase the sensitivity of nociceptors to painful stimuli and enhance the transmission of pain signals. Leukotrienes increase vascular permeability and smooth muscle contraction, which may contribute to edema and hyperalgesia in the surgical area. The decrease in prostaglandin and leukotriene production by dexamethasone contributes to a decrease in the sensitivity of nociceptors, nerve cells that detect and transmit pain signals. Dexamethasone can also directly reduce the expression of pain receptors (TRPV1 and TRPV4) in nociceptors, thereby reducing nociceptor activation and pain signal transmission. Dexamethasone has a strong anti-inflammatory effect that helps reduce pain after appendectomy surgery. The anti-inflammatory mechanism of dexamethasone involves inhibiting the activity of the enzyme cyclooxygenase (COX), which is responsible for the production of prostaglandins and leukotrienes, inflammatory mediators that increase the sensitivity of nociceptors and amplify pain signals. By inhibiting the production of inflammatory mediators and decreasing the sensitivity of nociceptors, dexamethasone helps reduce postoperative pain and improve patient comfort.¹⁰⁻¹³

Dexamethasone, a synthetic glucocorticoid, has anti-inflammatory effects that play an important role in enhancing the analgesic effect of TAP block in appendectomy patients. One of the key mechanisms of dexamethasone is to inhibit the migration of inflammatory cells, such as neutrophils and macrophages, to the surgical site. Dexamethasone

works at several levels to inhibit inflammatory cell migration. Dexamethasone decreases the expression of chemotactic receptors on neutrophils and macrophages so that these cells are less attracted to chemotactic signals released from the surgical site. These chemotactic signals attract inflammatory cells to areas of inflammation to fight infection or tissue damage. Dexamethasone inhibits the expression of cell adhesion molecules on neutrophils and macrophages, making these cells less able to adhere to the vascular endothelium. This is important for the migration of inflammatory cells because these cells must pass through the vascular endothelium to reach the surgical site. Dexamethasone induces apoptosis (programmed cell death) in neutrophils and macrophages. Apoptosis helps clear inflammatory cells from the surgical site, thereby reducing inflammation and potential tissue damage. Inhibition of inflammatory cell migration by dexamethasone has several positive effects in controlling pain after appendectomy surgery. Neutrophils and macrophages produce inflammatory mediators, such as prostaglandins and leukotrienes, which increase the sensitivity of nociceptors and amplify pain signals. Inhibiting the migration of these cells helps reduce the production of inflammatory mediators, thereby reducing inflammatory pain. Neutrophils and macrophages also produce proteolytic enzymes that can damage tissue in the surgical area. Inhibiting the migration of these cells helps prevent further tissue damage, which can reduce pain and speed recovery. Dexamethasone, through its anti-inflammatory effects, significantly contributes to the effectiveness of the TAP block in controlling post-appendectomy pain. Inhibiting the migration of inflammatory cells, such as neutrophils and macrophages, to the surgical area is one of the key mechanisms by which dexamethasone helps reduce the production of inflammatory mediators, prevent tissue damage, and ultimately reduce pain. Several studies have shown the effect of dexamethasone in inhibiting inflammatory cell migration and reducing postoperative pain. A study in mice found that dexamethasone significantly reduced the migration of neutrophils and macrophages to the surgical site after appendectomy, and also reduced

postoperative pain. A human study found that dexamethasone administered before appendectomy significantly reduced the migration of neutrophils and macrophages to the surgical site, and also reduced the need for postoperative opioid analgesics. This study supports the important role of dexamethasone in inhibiting inflammatory cell migration and enhancing the analgesic effect of TAP block in appendectomy patients.¹⁴⁻¹⁶

Dexamethasone, a synthetic glucocorticoid, has an analgesic effect that can increase the effectiveness of the TAP block in controlling pain after appendectomy surgery. One of the analgesic mechanisms of dexamethasone is by increasing the release of endorphins, endogenous neurotransmitters that have analgesic effects. Pro-opiomelanocortin (POMC) is a pro-hormone peptide precursor that is processed into various hormones, including endorphins. Dexamethasone increases POMC gene expression in various tissues, including the hypothalamus, pituitary, and peripheral nervous system. This increase in POMC expression results in more endorphin precursors being available for processing into active endorphins. The prohormone convertase enzyme is responsible for processing POMC into active endorphins. Dexamethasone increases the activity of this enzyme, thereby accelerating the conversion of POMC to endorphins. Cortisol, a stress hormone produced by the adrenal glands, can suppress the release of endorphins. Dexamethasone, with its anti-inflammatory and immunomodulatory properties, helps lower cortisol levels, allowing for greater release of endorphins. Endorphins bind to opioid receptors in the brain and spinal cord, activating descending analgesic pathways. This pathway inhibits the release of pain neurotransmitters, such as glutamate and substance P, at presynaptic and postsynaptic synapses. Dopamine is a neurotransmitter involved in reward and motivation systems. Endorphins increase the release of dopamine in areas of the brain associated with analgesia, enhancing their analgesic effects. Endorphins can reduce the activity of nociceptors, nerve cells that detect and transmit pain signals. This decrease in nociceptor activity helps reduce sensitivity to pain. Several studies have shown

that dexamethasone increases the release of endorphins and has an analgesic effect on various conditions, including postoperative pain. A study in patients undergoing Caesarean section found that intravenous dexamethasone increased endorphin plasma levels and reduced the need for opioid analgesics. A study in patients with acute low back pain found that oral dexamethasone increased endorphin plasma levels and reduced pain scores. A study in patients with cancer pain found that intrathecal dexamethasone increased endorphin levels in the cerebrospinal fluid and reduced pain scores. Dexamethasone increases the release of endorphins, endogenous neurotransmitters that have analgesic effects. This increased release of endorphins contributes to the analgesic effect of dexamethasone in controlling pain after appendectomy surgery. Dexamethasone, with its anti-inflammatory, immunomodulatory properties, and increased endorphin release, is an effective adjuvant to TAP block in controlling post-appendectomy pain.¹⁵⁻¹⁷

This study clearly shows that patients receiving TAP block with adjuvant dexamethasone for postoperative appendectomy pain do not require additional opioid analgesics. This shows the effectiveness of this combination in controlling pain and offers several important benefits. Opioids, such as morphine and codeine, are powerful analgesics that are often used to control post-operative pain. However, long-term use of opioids can lead to addiction, which is a serious public health problem. TAP block with adjuvant dexamethasone may help reduce opioid requirements, thereby lowering the risk of addiction. Opioids can cause a variety of unwanted side effects, such as nausea, vomiting, constipation, dizziness, and sedation. These side effects can interfere with patient recovery and reduce quality of life. TAP block with adjuvant dexamethasone may help reduce or eliminate these side effects, increasing patient comfort and speeding recovery. Excessive use of opioids can increase health care costs. TAP block with adjuvant dexamethasone may help reduce healthcare costs by decreasing opioid requirements and shortening hospital stays. The effectiveness of TAP block with adjuvant dexamethasone in reducing opioid

requirements can be explained by several biological mechanisms. TAP blocks block pain signals from the surgical area to the brain, thereby reducing pain. Dexamethasone helps reduce inflammation in the surgical area, which is one of the main causes of post-operative pain. Inflammation increases the sensitivity of nociceptors, nerve cells that detect pain, so dexamethasone can help reduce pain by reducing the sensitivity of nociceptors. Dexamethasone also has immunomodulatory effects that help reduce nociceptor sensitivity. Dexamethasone can reduce the expression of pain receptors (TRPV1 and TRPV4) in nociceptors and increase the release of endorphins, endogenous neurotransmitters that have analgesic effects. The combination of TAP block and adjuvant dexamethasone produces a stronger and longer-lasting analgesic effect compared to TAP block alone. This synergistic effect may explain why the patient in this case did not require additional opioid analgesics. TAP block with adjuvant dexamethasone is a safe and effective regional anesthesia technique for controlling pain after appendectomy surgery. This combination offers several important benefits, including reduced pain, decreased need for opioids, increased patient comfort, accelerated recovery, and reduced healthcare costs. The use of TAP block with adjuvant dexamethasone should be considered as a primary option for controlling post-appendectomy pain, especially for patients who are at high risk of opioid addiction or have undesirable side effects from opioid analgesics.¹⁶⁻¹⁸

Post-appendectomy pain can cause significant discomfort, disrupting sleep, mobility, and daily activities. This can slow the patient's recovery and lengthen the hospital stay. TAP block with adjuvant dexamethasone can significantly reduce postoperative appendectomy pain, as shown in this case report. Adequate sleep is essential for recovery. Lower pain can help patients sleep better and longer, which increases their energy and focus. Lower pain relief allows patients to move more easily without pain or discomfort. This helps them to do the physical activities necessary for recovery, such as walking and stretching. Lower pain allows patients to return to daily activities more quickly, such as eating, bathing,

and dressing. This improves their overall quality of life. Opioids can cause a variety of unwanted side effects, such as nausea, constipation, dizziness, and drowsiness. Reducing the need for opioids can help patients avoid these side effects and feel better overall. Long-term use of opioids can increase the risk of addiction. Reducing the need for opioids can help patients avoid these risks and improve their overall health. Post-appendectomy pain can slow down the patient's recovery by interfering with normal body functions. Postoperative inflammation can slow tissue recovery and increase pain. Dexamethasone in the TAP block can help reduce inflammation, thereby speeding tissue recovery and reducing pain. Postoperative pain can suppress the immune system, making patients more susceptible to infection. Reducing pain with TAP block and adjuvant dexamethasone can help improve immune system function and speed recovery. Lower pain and faster recovery can help patients get out of the hospital sooner, thereby saving on healthcare costs and improving quality of life. TAP block with adjuvant dexamethasone offers significant biological benefits in controlling post-appendectomy pain. Lower pain and less need for opioids can increase patient comfort, allowing them to recover more quickly and return to normal activities more quickly. In addition, it speeds up recovery and improves the patient's quality of life.^{19,20}

4. Conclusion

TAP block with adjuvant dexamethasone is a safe and effective regional anesthesia technique for controlling pain after appendectomy surgery. This combination offers several important benefits, including reduced pain, decreased need for opioids, increased patient comfort, accelerated recovery, and reduced healthcare costs.

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