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### Supraclavicular Block Using Ultrasonography (USG) Guidance in Ulna Radius Fractures Patients with Moderate Mitral Regurgitation Undergoing ORIF (Open Reduction and Internal Fixation): A Case Report

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#### A B S T R A C T

**Background:** Open fractures of the radius and ulna in elderly patients are conditions that require fast and appropriate treatment. Open reduction internal fixation (ORIF) is a common treatment option, but in elderly patients, general anesthesia may be high risk. Supraclavicular brachial plexus block is an effective and safe regional anesthetic option for ORIF in elderly patients. **Case presentation:** We report the case of a 71-year-old man with an open fracture of the left third radius and middle ulna who was planned for ORIF. The patient had comorbid hypertension and reduced left ventricular function. Supraclavicular brachial plexus block was performed using 0.5% bupivacaine (10 mL) and 2% lidocaine (10 mL). The patient did not complain of pain during the operation and recovered well. **Conclusion:** Supraclavicular brachial plexus block is an effective and safe regional anesthetic option for ORIF in elderly patients with open fractures of the radius and ulna.

#### 1. Introduction

Open fractures of the radius and ulna, especially in elderly patients, are a complex medical condition and require fast and appropriate treatment. This injury is often caused by high-energy trauma, such as a fall or motor vehicle accident. An open fracture is characterized by a break in the skin associated with the fracture, increasing the risk of infection and other complications. Open reduction internal fixation (ORIF) is a common treatment option for open fractures of the radius and ulna. This technique involves opening the wound, repositioning the broken bone, and fixation

with plates and screws. ORIF aims to restore normal bone anatomy, increase stability, and allow optimal bone healing. However, in elderly patients, the choice of anesthesia for ORIF can be a challenge. Elderly patients often have underlying comorbidities, such as heart, lung, or kidney disease, which may increase the risk of anesthesia complications. General anesthesia, which is the most common anesthetic technique, can cause hypotension, cardiac arrhythmias, and pulmonary complications in elderly patients.<sup>1,2</sup>

General anesthesia involves administering intravenous sedatives and anesthetic gas to induce

and maintain unconsciousness during surgery. This technique is very effective in providing analgesia and muscle relaxation, but in elderly patients, general anesthesia can pose some risks. General anesthesia can cause a significant decrease in blood pressure, especially in elderly patients with cardiac disease or hypovolemia. Hypotension can trigger organ ischemia, especially in the brain and heart, and increase the risk of serious complications. Sedatives and anesthetic gases can affect the heart rhythm and increase the risk of arrhythmias, such as atrial or ventricular fibrillation. Elderly patients with underlying heart disease are more susceptible to this complication. General anesthesia can cause respiratory depression and atelectasis (collapse of the lung alveoli), especially in elderly patients with chronic obstructive pulmonary disease (COPD). In patients with mitral regurgitation, a condition in which the heart's mitral valve does not close properly, the risk of anesthetic complications may be higher. Mitral regurgitation can be categorized as acute or chronic. Acute mitral regurgitation usually has a more severe clinical condition and requires immediate treatment, such as intubation, use of inotropes, diuresis, or dialysis. The main consideration in the anesthetic management of patients with mitral regurgitation is maintaining systemic flow. A higher heart rate should generally be maintained to decrease regurgitant volume. However, this may increase the risk of tachycardia and other arrhythmias.<sup>3,4</sup>

Supraclavicular brachial plexus block is a regional anesthetic technique that provides analgesia and muscle relaxation in the upper and lower arms. This technique involves injecting a local anesthetic into the brachial plexus, a collection of nerves located in the supraclavicular region, above the clavicle bone. Supraclavicular brachial plexus block offers several advantages over general anesthesia in elderly patients with open fractures of the radius and ulna. Supraclavicular brachial plexus block does not significantly affect heart and lung function, thereby reducing the risk of hypotension, cardiac arrhythmias, and pulmonary complications. Supraclavicular

brachial plexus blocks allow patients to recover more quickly from anesthesia, thereby reducing hospital stay and risk of infection. Supraclavicular brachial plexus blocks provide effective analgesia and can help reduce anxiety and pain in patients.<sup>5</sup>

## 2. Case Presentation

Male, 71 years old with diagnosis post debridement + immobilisation using Backslab (05/02/2024) due to open fracture left radius and ulna middle third was planned for open reduction internal fixation (ORIF). Based on anamnesis, the Patient complained of pain accompanied by swelling in the left forearm region. Pain in the forearm region is provoked by movement of the forearm either active or passive movement. Vital sign before operation was blood pressure of 161 /100 mmHg, heart rate 88 beats per minute, respiratory rate 16 times per minute, oxygen saturation (SpO<sub>2</sub>) of 98-99% and a pain rating scale 5 of 10. The laboratory exam result showed Hemoglobin of 12.10 g/dl, white blood count of 13.300/uL, hematocrit of 40,40% as well as platelet count of 282. x 10<sup>3</sup>/uL, serum creatinine 1,1, and Kalium serum 3,1. X-ray of the left wrist showed a complete fracture on 1/3 middle radius and ulna accompanied by soft tissue swelling. The patient was categorized into ASA III physical status with geriatric with good cognitive function, hypertensive heart disease on therapy of Amlodipine 10 mg, Bisoprolol 1 x 1,25 mg with echocardiography result: ejection fraction 48%, left ventricle concentric remodelling with mitral moderate as main a problem. Due to this problem, the patient was planned for a supraclavicular brachial plexus block.

The Patient was fasting for solid food and liquid for preoperative preparation. Ondansetron 8 mg as well as dexametasone 10 mg was administred as premedication. The patient was positioned supine and vital sign, such as blood pressure, respiratory rate, pulse rate, electrocardiography (ECG), and oxygen saturation were monitored. The supraclavicular brachial plexus block was performed on the right side of the patient using a regimen of 0.5% bupivacaine (10 mL) and 2% lidocaine (10 mL). For procedural, firstly

we injected lidocaine 2 % for local anesthesia and then we searched for brachial plexus. After we administered the regimen for regional anesthesia, the patient was monitored in the recovery room for around 20 – 30 minutes. During the operation, the patient didn't complain of any pain. The patient told us that he felt numbness in his forearm and a tingling sensation, however, he could feel any light touch sensation. The vital signs during the operation were stable. Heart rate around 70 – 80 times per minute, blood pressure around 120 – 130 / 80- 87 mmHg, respiratory rate at 16 times per minute, and oxygen saturation was 99% on nasal cannula 3 liters per minute. The operation lasted around 1 hour and 30 minutes. Before being transferred to the recovery room, the Patient's vital signs were stable with a heart rate of 78 times per minute, blood pressure of 128/78 mmHg, respiratory rate of 16 times per minute, and oxygen saturation of 99% the nasal cannula 3 liters per minute. For postoperative analgetic, the patient received 500 mg of paracetamol 4 times a day intraorally and 400 mg of ibuprofen 3 times a day intraorally.

### **3. Discussion**

Supraclavicular brachial plexus block provides analgesia and muscle relaxation in the upper and lower arms by blocking the brachial nerve in the supraclavicular region. The brachial nerve consists of several nerve fibers, including the musculocutaneous, median, ulnar, radial, and axillary nerves. Supraclavicular brachial plexus blocks work by disrupting the transmission of sensory and motor nerve impulses, resulting in numbness and weakness in the areas innervated by these nerves. In contrast to general anesthesia, supraclavicular brachial plexus block does not directly affect the function of the heart and cardiovascular system. This technique does not cause myocardial depression, changes in systemic vascular resistance, or decreased cardiac output. This makes supraclavicular brachial plexus blocks a safe and effective anesthetic option for elderly patients with cardiovascular comorbidities, such as hypertension, ischemic heart disease, or heart failure. Several

studies have shown that supraclavicular brachial plexus blocks do not cause significant hemodynamic changes in elderly patients. A study involving 60 elderly patients with radius and ulna fractures found that supraclavicular brachial plexus blocks did not affect blood pressure, heart rate, or cardiac index.<sup>6,7</sup>

General anesthesia can cause respiratory depression and atelectasis (collapse of the lung alveoli), especially in elderly patients with chronic obstructive pulmonary disease (COPD). This can increase the risk of lung infections and other respiratory complications. Supraclavicular brachial plexus block, as a regional anesthetic, does not cause significant respiratory depression. This technique allows patients to breathe spontaneously with minimal mechanical ventilation intervention. This may help prevent atelectasis and improve lung function in elderly patients, especially those with COPD. Several studies have shown that supraclavicular brachial plexus blocks can reduce the risk of pulmonary complications in elderly patients undergoing surgery. A study involving 100 elderly patients with radius and ulna fractures found that supraclavicular brachial plexus block was associated with a reduced risk of postoperative pneumonia compared with general anesthesia.<sup>8,9</sup>

Supraclavicular brachial plexus blocks have been shown to be beneficial in accelerating the recovery of elderly patients with open fractures of the radius and ulna. Supraclavicular brachial plexus block works by injecting a local anesthetic into the brachial plexus, a collection of nerves located in the supraclavicular region, above the clavicle bone. Local anesthetics block the transmission of sensory and motor nerve impulses, resulting in analgesia (pain relief) and muscle relaxation in the upper and lower arms. Postoperative pain can hinder mobilization and slow down the recovery process. Supraclavicular brachial plexus blocks provide effective analgesia, thereby helping to reduce patient pain and anxiety. This can improve the patient's sleep quality and mobility, as well as support the wound healing process. Postoperative pain can also increase the risk of wound infection. Lack of

mobilization due to pain can inhibit blood flow and the immune system, making patients more susceptible to infection. Supraclavicular brachial plexus blocks with their analgesic effects can help reduce the risk of infection and speed up wound healing. Supraclavicular brachial plexus blocks allow patients to get up and move around more quickly after surgery. Early mobilization is important to increase blood flow, strengthen muscles, and prevent complications such as deep vein thrombosis and pneumonia. Regional anesthesia such as supraclavicular brachial plexus block has been shown to be more effective in controlling postoperative pain compared with opioid analgesics. This can help reduce the risk of opioid addiction and its side effects, such as constipation, nausea, and vomiting. Several studies have demonstrated the effectiveness of supraclavicular brachial plexus blocks in accelerating the recovery of elderly patients with open fractures of the radius and ulna. A study compared the effects of supraclavicular brachial plexus block with general anesthesia in 60 elderly patients with open fractures of the radius and ulna. The results showed that patients who received supraclavicular brachial plexus blocks experienced less postoperative pain, faster recovery times, and higher levels of satisfaction compared with patients who received general anesthesia. Another study evaluated the effect of supraclavicular brachial plexus block in 45 elderly patients with open fractures of the radius and ulna. The results showed that patients who received supraclavicular brachial plexus blocks experienced faster early mobilization, fewer postoperative complications, and shorter lengths of stay compared with patients who received general anesthesia. Another study also examined the effects of supraclavicular brachial plexus blocks in 80 elderly patients with open fractures of the radius and ulna. The results showed that patients who received supraclavicular brachial plexus blocks experienced lower postoperative pain scores, fewer opioid requirements, and higher levels of satisfaction compared with patients who received general anesthesia.<sup>10-12</sup>

Supraclavicular brachial plexus blocks provide effective analgesia and can help reduce anxiety and pain in patients with open fractures of the radius and ulna. These analgesic and anxiolytic effects can be explained by several biological mechanisms involving interactions between local anesthetic drugs, the brachial nerve, and the central nervous system. The analgesic effect of supraclavicular brachial plexus blocks is mainly due to the blockade of the conduction of pain impulses in the brachial nerve. Local anesthetic drugs, such as bupivacaine and lidocaine, work by stabilizing nerve cell membranes, thereby preventing depolarization and transmission of pain signals to the central nervous system. Local anesthetic drugs block sensory nerves at the injection site, preventing the transmission of pain signals from peripheral nerves to the brachial plexus. The local anesthetic diffuses into the brachial plexus and blocks the sensory nerves at this level, preventing the transmission of pain signals to the spinal cord. Local anesthetic drugs can reach the spinal cord and block neurons in the posterior horn, which play a role in transmitting pain signals to the brain. In addition to the analgesic effect, supraclavicular brachial plexus blocks can also help reduce anxiety and fear in patients. Severe pain can trigger anxiety and fear. An effective supraclavicular brachial plexus block can reduce pain, thereby helping to relieve patient anxiety. The limbic system in the brain plays a role in regulating emotions, including anxiety and fear. Local anesthetic medications, such as bupivacaine, have been shown to have an effect on the limbic system and may help reduce anxiety. Supraclavicular brachial plexus block can affect the autonomic nervous system, which regulates the body's response to stress. This effect can help relieve physical symptoms of anxiety, such as increased heart rate and blood pressure. Several studies have demonstrated the effectiveness of supraclavicular brachial plexus blocks in providing analgesia and anxiolysis in patients undergoing various surgical procedures, including ORIF for radius and ulna fractures. A study involving 100 elderly patients with open fractures of the radius and ulna

found that supraclavicular brachial plexus blocks provided more effective analgesia and reduced anxiety compared with general anesthesia. Patients who receive a supraclavicular brachial plexus block experience less pain and anxiety during and after surgery, and recover more quickly from anesthesia. Another study involving 50 patients with radius and ulna fractures found that supraclavicular brachial plexus blocks improved patient satisfaction and reduced postoperative analgesic requirements compared with general anesthesia. Patients who received supraclavicular brachial plexus blocks were more satisfied with their anesthetic experience and required less pain medication after surgery. Supraclavicular brachial plexus block is a safe and effective regional anesthetic technique for ORIF in elderly patients with open fractures of the radius and ulna. This technique provides effective analgesia and can help reduce anxiety and pain in patients. The analgesic and anxiolytic mechanism of supraclavicular brachial plexus blocks is based on the blockade of the conduction of pain impulses in the brachial nerve and the influence on the central nervous system. Scientific evidence shows that supraclavicular brachial plexus blocks can improve patient satisfaction and reduce the need for postoperative analgesics compared with general anesthesia.<sup>13,14</sup>

Mitral regurgitation is a medical condition in which the heart's mitral valve does not close completely, causing backflow of blood from the left ventricle to the left atrium. Excess blood in the left atrium can increase left atrial and left ventricular pressure, which can lead to congestive heart failure. Uncontrolled backflow of blood can cause fatigue, shortness of breath, and palpitations. Increased left atrial pressure can increase the risk of atrial fibrillation, a heart arrhythmia that can be fatal. Mitral regurgitation can be categorized as acute or chronic. Acute mitral regurgitation usually occurs suddenly and can be caused by myocardial infarction, infective endocarditis, or mitral valve tear. Chronic mitral regurgitation develops slowly and can be caused by various conditions, such as rheumatic heart valve

disease, mitral valve degeneration, or congenital heart defects. Anesthesia in patients with mitral regurgitation presents several unique challenges. The primary consideration in anesthetic management is maintaining systemic flow and preventing cardiac complications. A higher heart rate should generally be maintained to reduce the volume of regurgitation and maintain blood flow to vital organs. However, this may increase the risk of tachycardia and other arrhythmias. Certain anesthetic drugs and anesthetic techniques can suppress myocardial function, which may worsen mitral regurgitation and increase the risk of heart failure. Hypovolemia, or insufficient blood volume, can worsen mitral regurgitation and cause hypotension. It is important to maintain patient hydration and closely monitor volume status. The anesthetic approach in patients with mitral regurgitation should be tailored to the severity of the regurgitation, cardiac functional status, and other comorbidities. Regional anesthetic techniques, such as supraclavicular brachial plexus blocks, can provide analgesia and muscle relaxation for certain procedures, thereby reducing the need for general anesthesia. Carefully controlled general anesthesia may be used for more complex procedures. It is important to select anesthetic drugs and anesthetic techniques that have minimal effects on myocardial function and blood pressure. Inotropics, such as dobutamine, may be used to increase cardiac contractility and maintain systemic flow. Close hemodynamic monitoring is essential to track blood pressure, heart rate, cardiac output, and oxygen saturation during surgery. Several studies have investigated the optimal anesthetic choice for patients with mitral regurgitation. A meta-analysis study involving 12 studies found that regional anesthesia was associated with a lower risk of perioperative mortality in patients with mitral regurgitation. Another study showed that carefully controlled general anesthesia with close hemodynamic monitoring can be safe and effective for patients with mitral regurgitation.<sup>15,16</sup>

#### 4. Conclusion

Open fractures of the radius and ulna in elderly patients are a complex medical condition and require fast and appropriate treatment. General anesthesia in elderly patients with open fractures of the radius and ulna can pose a risk of complications, such as hypotension, cardiac arrhythmias, and pulmonary complications. Mitral regurgitation, a condition in which the heart's mitral valve does not close properly, can worsen the risk of anesthesia complications. Supraclavicular brachial plexus block is a safe and effective regional anesthetic option for ORIF in elderly patients with open fractures of the radius and ulna and with mitral regurgitation.

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