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Brief Review: Regional Anesthesia for Vaso-occlusive Pain Crises

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Abstract:

Vaso-occlusive pain crisis occurs with obstruction of blood vessels from sickled red blood cells. This results in ischemic injury causing in pain. Acute vasoocclusive pain crisis are one of the most common reasons for patients with sickle cell disease to present to the hospital for medical attention. Acute treatment involves IV opioid therapy, non-opioid therapy, and IV hydration. There is a known lack of trust between a patient in acute pain and a provider in the emergency department (ED) and hospital secondary to stereotypes regarding pain seeking behavior. Here we discuss a case of vasoocclusive pain crisis refractory to opioid therapy and local regional anesthesia as an alternative treatment.

Illustrative Case:

A 27-year-old female with past medical history of sickle cell disease, splenectomy, and avascular necrosis of left hip with replacement presented to the emergency department for generalized body aches. Further complaints included shortness of breath and chest pain. The patient reported that the symptoms were typical of her sickle cell pain crises. She reported however, that this pain was worse than typical episodes. The patient reported treatment at an infusion unit with intravenous fluids and pain medications prior to arrival with no relief of pain. She stateed that she uses ibuprofen for breakthrough pain at home. The social history was negative for tobacco, alcohol, and drug use.

On presentation, her vital signs were as follows: blood pressure of 108/92 mmHg, heart rate of 85 beats per minute, respiratory rate of 16, temperature of 98.4°F, and pulse ox of 96% on room air. BMI was 24.90 kg/m2.

Physical examination revealed a female in acute distress. She was not ill appearing or diaphoretic. On auscultation, there was normal rate and regular rhythm. No audible murmurs. Lungs were clear to auscultation. No wheezing and no rhonchi. Abdomen was soft and non-tender. Patient had full range of motion of all extremities despite pain.

A chest X-ray was performed which showed mild cardiomegaly and a right sided port-a-cath. Electrocardiogram showed normal sinus rhythm at 77 bpm with no acute ST-T changes. Lab work was significant for a reticulocyte count of 4.7%. CBC showed leukocytosis with WBC count of 15.2. Hemoglobin was low at 6.6. Troponin and BMP were unremarkable. Chest X-ray was unremarkable with no consolidation, pleural effusion, or pneumothorax. Patient received several rounds of IV opioid pain therapy and pRBC transfusion with no relief and was admitted for intractable pain secondary to vaso-occlusive pain crisis.

In this case, other forms of pain medications were not administered. In this review we will discuss local regional anesthesia as a possible method for pain control in vaso-occlusive crises.

Discussion:

Sickle-cell disease (SCD) is the most common globin gene disorder: across the world, and roughly 300,000 children are born with it each year. The pain of sickle-cell crisis is a major health problem and oftentimes challenging to manage. Frequent or intense painful vasoocclusive crises (VOC) are associated severe complications of the disease, such as acute chest syndrome, acute multi-organ failure, or death. The mainstay of pain control utilize opioids. Opioid induced adverse effects include sedation and respiratory depression which can cause hypoxemia and atelectasis, worsening the underlying sickle cell disease pathophysiology. With frequent use of opioids there is tolerance which can result in increased dosage requirements.

To decrease the risks associated with opioid therapy, adjunctive therapies have been utilized, including alternative analgesic drugs, nerve block, physiotherapy, orthopedic intervention or surgery, cognitive behavior therapy, and muscle relaxants. Regional anesthesia results in vasodilation and reduces the inflammatory response. There was a study to assess the effectiveness of local regional anesthesia in reduction of pain in vasoocclusive crisis for patients with refractory pain despite multimodal therapy. The study utilized a large population of West Indians at French West Indies University Hospital of Guadeloupe who were diagnosed with sickle cell disease, and they were followed over a 6-month period. The primary outcome was defined using a numeric pain score and a percentage of change in opioid use. Nine adults with SCD undergoing a vaso-occlusive crisis were enrolled and administered local regional anesthesia. Within 24 hours opioid reduction was -75%. This means that there was a 75% reduction in opioid use after using LRA. Pain scale additionally reduced from 9/10 severity pre-block to 0-1/10 post block.

Five studies, including one case series with three patients and four case reports, employed peripheral nerve blocks for regional anesthesia. In general, local regional anesthesia (LRA) exhibited a reduction in pain and symptoms, along with a decrease in opioid consumption post-procedure. The block duration of analgesia was 12– 16 hours with reinjection needed in 50% of patients. The most common medications used were Bupivacaine and Ropivacaine. Procedural related risks including infection, hematoma and neurological injury such as peripheral neuropathy exist; albeit the incidence is low. Paresthesia and local anesthetic systemic toxicity can also result.

The beneficial effects of local regional anesthesia for refractory pain include pain control, reducing opioid usage, reducing inflammation, and reducing HbS polymerization and adhesive events via vasodilation.

Case report utilizing regional anesthesia in pediatric population

In the pediatric population, low dose ketamine has been utilized and can provide adequate pain control, however, has unfavorable side effects including hallucinations. In this case, a 14-year-old male with history of sickle cell anemia was admitted for intractable pain secondary to vasoocclusive crisis of the right ankle. He was treated with Hydromorphone, Toradol, Acetaminophen, and Morphine with no relief of pain. Despite these efforts, the patient had continued pain and was treated with popliteal sciatic nerve block. Under ultrasound guidance, he received a 20 ml bolus of 0.1% Ropivacaine and an infusion of 0.1% Ropivacaine. This patient's pain decreased from 9/10 in severity to 3/10 immediately after the nerve block and his Hydromorphone requirements decreased.

Another case involved a 15-year-old male with history of sickle cell anemia who presented with bilateral hip and thigh pain vaso-occlusive crisis. He was treated with Morphine and anti-inflammatory medications, however, was admitted for intractable pain. A femoral nerve block and pericapsular nerve blockade was performed with 0.25% Bupivacaine with Dexmedetomidine. Immediately after the procedure, the patient's pain severity decreased to 0/10 and after 24 hours he no longer required opioid therapy.

Conclusions:

These studies demonstrated that regional anesthesia is effective for pain control and decreasing the necessity of opioid therapy. Recurrent vaso-occlusive crisis requiring opioid therapy results in tolerance and dependence which is the root of frustration when this patient population present in the hospital setting. Regional anesthesia promotes vasodilation with can improve blood flow to the ischemic area. Patients with isolated limb crises are good candidates for regional anesthesia. Regional anesthesia may not be feasible when the pain is not localized. Further studies should be performed to understand the effects of regional anesthesia in vaso-occlusive crises.

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