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Use of Fentanyl Titration for Severe Headache in a Patient with a Rare Type of Ruptured Cervicomedullary Dural Arteriovenous Fistula a Case Report

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Abstract

We report a case of a 40-year-old male with a 1 day history of neck stiffness and severe neck pain with numerical rating scale of 10/10 after undergoing soft neck massage with no neck thrusting on spinal manipulation. There was no noted dizziness, blurring of vision, nausea or vomiting, focal weakness or numbness. Neurologic examination was normal. Initial management included intravenous infusion of Paracetamol with adjunctive muscle relaxants but afforded no relief. Patient refused cranial imaging hence, he was admitted for observation and treatment. Pain was controlled using the combination of Tramadol given via a patient-controlled analgesia (PCA) machine, Paracetamol infusion, Baclofen and Eperisone. Initial impression was a simple musculoskeletal strain, however on the third day of admission, there was progression of headache with associated nuchal rigidity. On cranial computed tomography (CT) scan, subarachnoid hemorrhage was noted. Cerebral CT angiography was done and the patient was found to have right cervicomedullary dural arteriovenous fistula (DAVF). He subsequently underwent embolization of the DAVF. Post-operative pain was controlled using escalation dose of PCA fentanyl and other adjunctive analgesics. Pain was eventually controlled and opioid requirement was eventually down titrated and eventually removed 1 week post discharge.

This case report demonstrates the severity of pain caused by a ruptured cervicomedullary DAVF and the use of PCA fentanyl during the acute stages of pain control.

Keywords: Cervicomedullary Dural Arteriovenous Fistula (DAVF), Subarachnoid Hemorrhage, Fentanyl Titration, Pain Management, Patient-Controlled Analgesia (PCA)

Introduction

Dural arteriovenous fistulae (DAVF) are vascular abnormalities found in arteries arising from branches of the carotid or vertebral arteries that shunt into the dural leaflets of the venous sinuses [1]. They are seen within the epidural space in between the sheets of the dura mater and are formed by an atypical connection between arteries and veins [2].

The etiology is still undetermined but a majority of cases are acquired. It is still believed that the development of DAVF has certain characteristics which are embryologically related. In previous studies, the incidence has been reported at 0.15-0.29 cases per 100,000 persons per year, however there are no updated studies that investigated current incidence [3]. There are several classifications described and the degree of cortical venous reflux has been determined to. correspond with the higher probability of hemorrhage.

Rupture of DAVF has a consequential effect causing significant functional disability hence early diagnosis is important [4]. According to the 2022 American Heart Association guidelines for stroke, treatment options include conservative therapy, endovascular embolization, microsurgical disconnection of the cortical venous drainage, stereotactic radiosurgery or a combination thereof [5]. Together with all the treatment strategies that can be offered to patients, it is important to consider the adequate control of patients' symptoms.

Literature on pain control among patients with ruptured arteriovenous fistula has been scarce. The symptom of headache will appear once rupture has occurred and in the presence of subarachnoid hemorrhage or secondary to a craniotomy [6]. It reported that paracetamol is used as the primary analgesics and opioids as a co-analgesic for severe pain. However patients who are given high doses are feared to develop untoward effects such as nausea, vomiting, ileus, hemodynamic instability or respiratory depression. Another feared complication is the development of tolerance due to prolonged opioid use. Opioids are also avoided because of its untoward effects such as sedation may mask a progression of neurological symptoms.

The International Association for the Study of Pain (2018) stated that for humane reasons, opioids are indispensable for the treatment of acute severe short-lived non-malignant pain. However, it must be prevented amongst patients suffering chronic pain that is non-malignant in etiology.

This case report highlights the use of high dose fentanyl in a patient who initially presented with severe nape pain and stiffness secondary to a ruptured cervicomedullary DAVF.

Objectives

1. To present a case of an unusually severe headache in a patient with ruptured cervicomedullary DAVF
2. To present an effective titration of PCA Fentanyl during an acute pain crisis in a patient with subarachnoid hemorrhage secondary to a ruptured cervicomedullary DAVF.

Significance

DAVF is a rare cause of subarachnoid hemorrhage and is considered an emergency condition presenting as a severe headache with significant mortality and morbidity [7]. In terms of pain control, several pharmacologic treatment options for subarachnoid hemorrhage are available. Paracetamol is considered first line treatment, while opioids, NSAIDS and other non- opioid analgesics are second line [8]. Severity and grading of pain has however been different among patients and there are limited reports on the use of high dose opioids delivered via a PCA.

This case report highlights the importance of pain control in a very rare case of DAVF in the cervicomedullary region of the brain.

Case History

This is a case of a 40 year old male who presented a 1 day history of neck pain with numerical rating scale (NRS) of 10/10 with associated neck stiffness. The patient was previously well and has no known comorbidities but has a 12 pack year history of smoking, switching to heavy vaping only 3 years prior. He is an alcoholic beverage drinker consuming approximately 3- 5 bottles of beer 3x-4x a week. He was able to use methamphetamine approximately 2-3x for the past 2 years. Patient has a family history of leukemia but no history of known arteriovenous malformation.

Symptoms started 2 days prior to consultation when he went for a massage wherein minimal manual manipulation of the neck area was done. There was no thrusting neck motions or spinal manipulation done. 24 hours after the massage, the patient noted progressive severe neck pain with associated neck stiffness. There was no associated headache, nausea, vomiting, blurring of vision, focal weakness or numbness. Physical exam was unremarkable except for point tenderness on bilateral paracervical areas. Complete neurologic exam showed normal results with the emphasis that there was no nuchal rigidity. Due to the extreme pain, consultation was done at the Emergency room where cervical x-ray showed a straightened cervical spine. Initial pain medications given include Paracetamol 1g IV infusion and t tablet of Eperisone 50mg/tablet.

During the stay in the Emergency room, there was persistence of severe neck pain and stiffness, hence CT scan was advised but was not done due to lack of consent from the patient's family. Patient was then advised admission with the initial impression of musculoskeletal strain and was referred to the pain service. Initial pain regimen started is as follows:

1. Baclofen 10mg/tablet, ½ tablet every 8 hours
2. Eperisone 50mg/tablet, 1 tablet every 8 hours
3. Paracetamol 1g IV every 8 hours
4. PCA Tramadol with a basal rate of 8 mg/ hour, bolus rate of 4mg/demand and a lock out rate of 30 minutes.

While admitted, pain was controlled to NRS 4-5/10 and pain medications were gradually down titrated until the third day of admission, when the patient suddenly complained of progression of neck pain of NRS 10/10 still with associated neck stiffness. On examination, there was note of nuchal rigidity hence MRI of the brain using 1.5 Tesla unit in multiplanar views was done which showed Acute lacunar infarct, right splenium of the corpus callosum; multiple enhancing flow void signals at the right perimedullary cistern and in the cisterna magna, with diffuse subarachnoid hemorrhage. Minimal intraventricular hemorrhage; mild hydrocephalus with subependymal CSF seepage with no abnormal parenchymal or meningeal enhancement.

PCA Tramadol was then shifted to PCA Fentanyl with the initial setting of basal rate of 10 mcg/hour, bolus rate of 5mcg/demand with the lock out rate of 15 minutes. PCA Fentanyl was slowly uptitrated according to response. The patient was then placed under neurological critical care monitoring, given the following medications. 1. Nimodipine IV drips 10mg/50mL at 1mg/hour 2. Levetiracetam 500 mg/IV every 12 hours and 3. Lactulose 30mL at bedtime 4. Nicardipine for BP control 5. Mannitol 0.5g/kg every 6 hours 6. Atorvastatin 20mg/tab once a day.

Rehabilitation Medicine, Cardiology, Neurology and Neurosurgery services were then called on board and further work-ups were done. Follow-up CT angiogram of the brain showed arteriovenous malformation (AVM) with associated saccular aneurysms along the right lateral cerebellomedullary cistern and cisterna magna.

On the fifth hospital day (5/12/23), patient underwent transradial diagnostic cerebral angiography and was noted to have right cervicomedullary DAVF with feeding artery from the right posterior inferior cerebellar artery branch draining into the cervical plexus. This was then followed by transfemoral embolization of the right cervicomedullary dural fistula using liquid embolic agent which the patient tolerated well.

Post operatively, the patient had a normal neurologic examination. He was closely monitored in the neurology intensive care unit where neurological vital signs remained stable except for persistence of neck pain with associated left sided headache with NRS of 8/10. There was note of increasing PCA Fentanyl demands thus requiring uptitration of the PCA Fentanyl basal rate. The PCA setting that afforded relief was noted as follows: 90 mcg/hour basal rate, bolus rate of 45mcg/ demand and a lock out rate of 15 minutes. Other pain medication adjuncts were also modified:

1. Baclofen was increased to 10mg/tab, 1 tablet every 8 hours
2. Pregabalin 50 mg/capsule at bedtime
3. Celecoxib 200mg/tab every 12 hours for 10 doses

2 days post embolization, repeat CT scan of the brain showed no evidence of acute intracranial hemorrhage, territorial infarct, focal edema or discrete mass, resolution of minimal intraventricular hemorrhages and resolution of mild hydrocephalus.

4 days after embolization, the patient's pain started to decrease in severity and other vital parameters continued to remain stable hence all cardiovascular and neurology medications were shifted orally. PCA Fentanyl was gradually down titrated to a basal rate of 30 mcg/hour, bolus rate of 15 mcg/hour and lock out rate of 15 minutes. Upon discharge at 8 days post embolization, the patient did not have functional deficits and pain status remained stable. Pain medications were shifted to Fentanyl patch of 25 mcg/hour, Paracetamol 500 mg/tablet, 1 tablet every 6 hours as needed for pain scale more than or equal to 4/10, and Pregabalin 50 mg/capsule, 1 capsule at bedtime.

On follow-up a week after discharge, patient had very good pain control and Fentanyl patch was removed and patient was put on as needed Paracetamol 500 mg

Discussion

Cervicomedullary DAVF is rare and rupture of this malformation causing subarachnoid hemorrhage or myelopathy is a medical emergency [9]. There are very limited studies on patients presenting with cerebellomedullary DAVF and there are no studies published regarding the pain control among these patients. Among the patients with DAVF, only 2% occurs around the cervical spine and patients with this type of lesion usually present with intracranial bleed or myelopathy causing symptoms of headache, nape pain and stiffness as seen in our patient [10].

Our patient's initial presentation was nape pain and stiffness with a documented subarachnoid hemorrhage on plain cranial CT scan. Pain is the most common initial manifestation of patients with subarachnoid hemorrhage of whatever cause. Headache or nape pain is usually initially treated by the attending physician who is usually a neurologist. Referral to a pain specialist is rare, and if ever done, occurs late in the course of the illness. Therapeutic management of subarachnoid hemorrhage is multimodal and options include control of cerebral vasospasm, prevention of rebleeding, anticoagulant reversal, inhibition of the inflammatory pathways and initiation of an effective pain regimen [11].

In a study made by Barpulari, et al, it has been found that among patients with subarachnoid hemorrhage, there is limited pain relief observed with both the use of paracetamol and low dose opioids. Despite this review, there are no standard recommendations on how opioids are to be prescribed and titrated. The initial presentation of our patient was a severe headache and neck stiffness with no associated objective neurologic finding that will point to a central cause of headache. The progressive pain was uncontrolled by low dose Tramadol, prompting further imaging. Pain service then shifted to low dose PCA Fentanyl with a running basal rate of 10 mcg/hour. Post embolization of the arteriovenous fistula, headache and nape pain progressively increased to numerical rating scale of 8-9/10 hence PCA Fentanyl was gradually increased until a basal rate of 90 mcg/hour. Figures 1-4 below demonstrates the patient's pain scale and dose of opioid and co-analgesic adjuvants the patient used during the course of the disease.

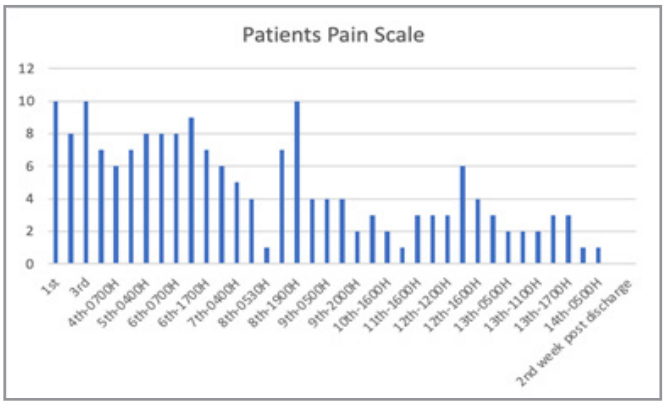

Figure 1: Patient's Daily Pain Scale Level While Admitted

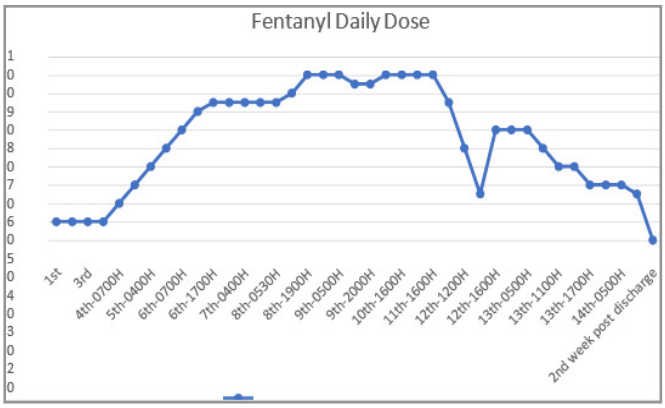

Figure 2: Fentanyl dose given during the hospital stay. X- Axis represents the hospital day while Y- Axis represents the amount of medication administered.

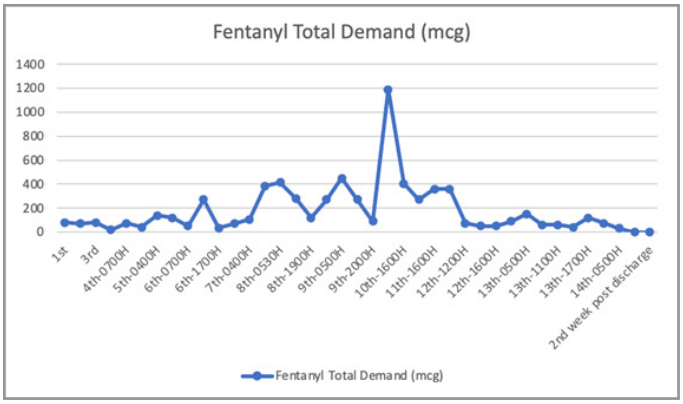

Figure 3: Fentanyl demand dose given during the hospital stay. X- Axis represents the hospital day while Y- Axis represents the amount of medication administered.

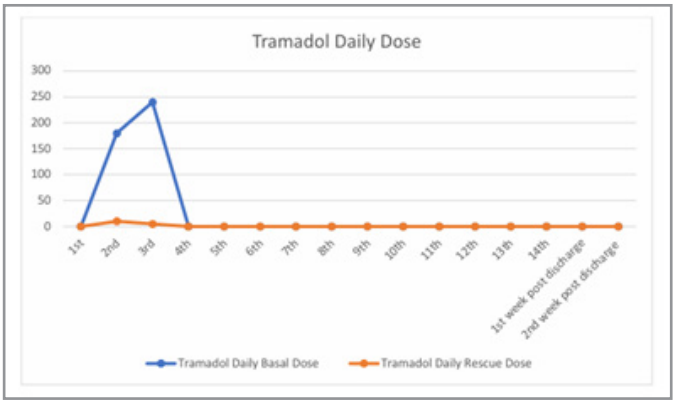

Figure 4: Tramadol dose given during the hospital stay. X- Axis represents the hospital day while Y-Axis represents the amount of medication administered.

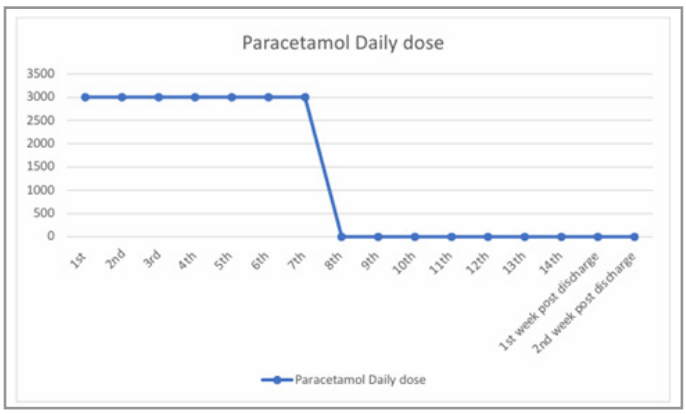

Figure 5: Paracetamol given during the hospital stay. X- Axis represents the hospital day while Y-Axis represents the amount of medication administered.

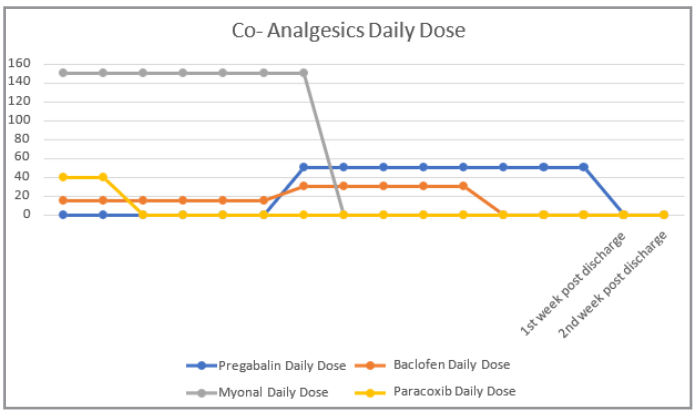

Figure 6: Co-analgesic adjuncts given during the hospital stay. X- Axis represents the hospital day while Y-Axis represents the amount of medication administered.

With a very high dose of opioids, there is always fear of the development of dependence and tolerance. Our patient did not have a history of previous opioid use. Although he was prescribed with more than 2 weeks (18 days) of strong opioids, there were no observed side effects such as increased sleeping time, decrease in sensorium, respiratory depression, nausea or decreased gastrointestinal motility. When pain was controlled at 4 days post embolization, the opioid dose was immediately down titrated to a baseline rate of 25 mcg/hour in the span of 4 days based on the subsequent improvement of the patient's pain scores. Throughout the stretch of time while the patient was being given opioids, he maintained a good cognitive functioning and normal neurologic exam. There was also no note of signs of withdrawal as the dose of Fentanyl was down titrated and eventually discontinued a week after discharge. Patient remained pain-free with no use of other opioids or any co-analgesics on the second week of follow-up.

Conclusion

Pain is one of the most common complaints of patients with ruptured DAVF. This is a rare case report that demonstrates the successful use of a strong opioid as the primary analgesic to control pain with Pregabalin, Paracetamol, muscle relaxants and Celecoxib as co-analgesics. This also demonstrates the increased opioid requirement on a patient who suffered rupture of the DAVF in the cervicomedullary area.

Our study highlights the necessity for a thorough evaluation of neurological and mental status and its value in the assessment and reassessment of illness progression or regression vis- a-vis the management of pain using opioids. A good clinical evaluation will allow clinicians to determine if clinical deterioration is from disease progression or opioid side effect. Another thing to be considered is the importance of immediate down titration of the strong opioids once acute illness has recovered in order to prevent the development of tolerance and dependence among patients.

References

1. Zyck, S., De Jesus, O., & Gould, G. C. (2023). Dural Arteriovenous Fistula. In StatPearls. StatPearls Publishing.
2. Murai, S., Hiramatsu, M., Suzuki, E., Ishibashi, R., Takai, H., & Date, I. (2021). Trends in Incidence of Intracranial and Spinal Arteriovenous Shunts. Stroke, 52(4), 1455–1459. https://doi.org/10.1161/strokeaha.120.032052

3. Kumar, M. R., & Agrawal, A. (2013). Non - Aneurysmal subarachnoid hemorrhage. ResearchGate. https://www.researchgate.net/publication/259893274_Non_-_Aneurysmal_subarachnoid_hemorrhage
4. Ye, X., Wang, H., Huang, Y., Zhou, S., & Gao, X. (2014). Surgical treatment for ruptured dural arteriovenous fistula with large intracranial hematoma. International journal of clinical and experimental medicine, 7(12), 5244–5251.
5. Reynolds, M. R., Lanzino, G., & Zipfel, G. J. (2017). Intracranial Dural Arteriovenous Fistulae. Stroke, 48(5), 1424–1431. https://doi.org/10.1161/STROKEAHA.116.012784
6. Bernardini, G. L., & Brust, J. C. M. (2021). Pain Control in Aneurysmal Subarachnoid Hemorrhage Patients in the ICU: Can We Avoid Contributing to the Opioid Crisis?. Neurology, 96(19), 873–874. https://doi.org/10.1212/WNL.0000000000011907
7. Barpujari, A. (2021). Pharmaceutical Management for Subarachnoid Hemorrhage. PubMed Central (PMC). https://www.ncbi.nlm.nih.gov/pmc/articles/PMC8722500/
8. Tanaka M. (2019). Embryological Consideration of Dural AVFs in Relation to the Neural Crest and the Mesoderm. Neurointervention, 14(1), 9–16. https://doi.org/10.5469/neuroint.2018.01095
9. Sun, H. S., Yun, H. S., Song, M. K., Han, J. Y., Choi, I. S., & Lee, S. G. (2011). Dural arteriovenous fistula on the brain stem and upper cervical spinal cord - a case report -. Annals of rehabilitation medicine, 35(5), 733–737. https://doi.org/10.5535/arm.2011.35.5.733
10. Bernardini, G. L., & Brust, J. C. (2021). Pain Control in Aneurysmal Subarachnoid Hemorrhage Patients in the ICU. Neurology, 96(19), 873–874. https://doi.org/10.1212/wnl.0000000000011907
11. Opioids for pain management (2021) International Association for the Study of Pain (IASP). https://www.iasp-pain.org/advocacy/iasp-statements/opioids-for-pain-management/