



Case Report

Early surgical correction of cervical disc herniation might avoid complications associated with opioid-based pain management: A case report

Ramsis Ghaly^{1,2,3}, Ana Pleasca¹, Kenneth D. Candido^{1,2}, Nebojsa Nick Knezevic^{1,2}

Department of Anesthesiology, ¹Advocate Illinois Masonic Medical Center, ²University of Illinois, Chicago, IL, ³Ghaly Neurosurgical Associates, Aurora, IL, United States.

E-mail: *Ramsis Ghaly - rfgghaly@aol.com; Ana Pleasca - plesca.ana@gmail.com; Kenneth D. Candido - kdcandido1@gmail.com; Nebojsa Nick Knezevic - nick.knezevic@gmail.com



*Corresponding author:

Ramsis Ghaly,
Ghaly Neurosurgical Associates,
4260 Westbrook Dr,
Suite 127 Aurora, Illinois 60504,
United States.

rfgghaly@aol.com

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ABSTRACT

Background: Opioids are considered an effective method for acute and chronic pain management, but they are not suitable for all cases and should be used in carefully selected patients. In the past several decades, their use has come under intense scrutiny due to significant deviations from the classically described applicability of opioids in cancer-related pain.

Case Description: A 34-year-old female with a 6-year history of worsening neck pain and suboccipital headaches was managed medically including the use of oral muscle relaxants, steroids, gabapentin, and opioid-based medications as well as interventional pain procedures that provided only temporary pain relief. She made repeated ER visits and had multiple hospital admissions for pain control, during which times she was placed on patient-controlled analgesia with IV hydromorphone administration. During the most recent admission for an acute exacerbation of chronic pain, she was found by her mother to be unresponsive and not breathing. A code blue was called and cardiopulmonary resuscitation per an advanced cardiac life support algorithm was conducted. The patient was successfully resuscitated and was discharged from the hospital in satisfactory condition. This incident was reported as an “allergic reaction” to hydromorphone. After consultation with a neurosurgeon, the patient underwent a definitive surgical intervention consisting of a C5–6 anterior cervical discectomy and fusion using an interbody spacer and anterior instrumentation. Within 6 weeks, she reported significant decreases in her pain, stopped using the pain medication, and was able to return to her normal lifestyle.

Conclusions: The present case report is an example of long-term pain management with multiple medications, including opioid use and performing interventional pain procedures, while avoiding early surgical correction of cervical disc herniation. This resulted in years of suffering with pain and serious morbidity from opioid overdosing. Surgical intervention was definitive in terms of ultimately improving her pain and reducing her reliance on opioid analgesics.

Keywords: Cervical disc herniation, hydromorphone side effects, surgical correction

INTRODUCTION

The annual prevalence of neck pain varies between 15% and 50% in the USA.^[11] Cervical disk herniation (CDH) leading to cervical radiculopathy is one of the most common causes of neck pain, and its incidence stands at 5–20 new cases per 1000 adults between their third and fifth decades of life.^[14]

Nerve root compression is not painful in the absence of inflammation, and inflammation of the nerve roots may occur in the absence of a compressive lesion. This may explain why the prevalence of CDH in asymptomatic subjects is 3–10% in the population under 40 years of age.^[8]

Clinical presentation of cervical radiculopathy is polymorphic. Patients may report typical symptoms such as localized neck pain with or without radiating arm pain, diminished reflexes, loss of sensation, and motor weakness. However, atypical presentations of CDH are also common. Neck pain as a result of the CDH is further associated with several comorbidities including headache, back pain, arthralgias, and depression.

The present case report is an example of the medical management of radicular cervical pain using a prescription of multiple pain medications, including opioids and performing interventional pain procedures, while avoiding early and timely surgical correction of CDH. This resulted in years of suffering with pain and the serious complication of opioid overdose leading to a near-death experience.

CASE REPORT

A 34-year-old female with a 6-year history of worsening neck pain, suboccipital headaches, bilateral shoulder blade and axial spine pains, and sensory abnormalities in the hands and neck presented to the author for a second opinion. The pain on the right side, including the upper and lower extremities, was much more severe than that on the left side. The pain was rated 6/10 on a numeric rating scale and was described as being constant, sharp, stabbing and increased with activities such as neck movement, coughing, or sneezing.

Her previous medical management included the use of oral muscle relaxants, steroids, gabapentin and opioid-based medication (Norco 10/325 mg, up to 4 times a day), nonsteroidal anti-inflammatory drugs, and diazepam, with the patient reporting incomplete relief of symptoms and even occasional worsening episodes. Physical therapy and chiropractic treatment, as alternative modalities, had been attempted unsuccessfully. Cervical epidural steroid injections, medial branch injections, radiofrequency ablations, and trigger point injections had also been administered, with only temporary relief of pain symptoms.

Past medical history was significant for colitis, depression, and migraine headaches for which she had been receiving sumatriptan, acetaminophen, propranolol, topiramate, and carbamazepine. The patient made repeated ER visits and multiple hospital admissions for pain control, during which she was placed on patient-controlled

analgesia (PCA) with IV hydromorphone administration. During the most recent admission for an acute exacerbation of her chronic pain, the same regimen was administered, and on day 2 of the hospitalization while using the PCA, she was found by her mother to be unresponsive and not breathing. A code blue was called and cardiopulmonary resuscitation per the advanced cardiac life support (ACLS) algorithm was implemented. The patient was successfully resuscitated and was discharged from the hospital in satisfactory condition without neurological compromise. She was told by hospital officials that she has an allergy to hydromorphone and that she should avoid using it in the future. After this experience, the patient decided to wean off all non essential pain medication, while still using hydrocodone/acetaminophen 10/325 mg 2 times a day, and to consider surgery as a treatment option.

MRI and CT scans of the cervical spine revealed a severe central C5–6 calcified disc herniation and at the same level spinal cord stenosis with evidence of osteophyte formation. Both passive and active ROMs reproduced neck pain with radiation to the arms bilaterally. There was also trapezius muscle tenderness. Motor strength was 4/5 in both the upper and lower extremities. Neurological examination demonstrated absent biceps and triceps deep tendon reflexes, as well as poor tandem gait, but was otherwise unremarkable.

After reviewing the medical records associated with the case, there was no official medical record about the alleged cardiac arrest secondary to hydromorphone overdose. The history and clinical examination were compatible with an incompletely managed C5–6 radiculomyelopathy. Subsequently, the patient underwent a definitive surgical correction using a C5–6 anterior cervical discectomy and fusion using an interbody spacer and anterior instrumentation. Three weeks before the surgery, the patient stopped taking any opioid pain medication. During the perioperative period, she received parenteral hydromorphone without any untoward reactions. Anesthesia was induced with IV propofol/remifentanyl and 1 mg hydromorphone. In the recovery period, she received another 1 mg of hydromorphone IV. In the next 24 h after the surgery, while being on the ward, she was administered 3 mg of oral morphine every 3 h, acetaminophen/hydrocodone 10/325 mg every 4 h, and cyclobenzaprine 10 mg 3 times a day.

After the surgery, the treatment consisted of oral muscle relaxant use 3 times a day and acetaminophen/hydrocodone 4 times/day for 2 weeks, physical therapy, and transcutaneous electrical nerve stimulation therapy. Within 6 weeks, she reported a significant decrease of the myofascial pain component, with no numbness or tingling radiating to the arms, improvement in the range of motion of the neck, and no pain medication use. After 7 years of follow-up, the patient remains pain free, uses only naproxen as needed, and has been able to return to her normal lifestyle.

DISCUSSION

CDH is a common form of compressive cervical radiculopathy, which occurs when there is an extrusion of the intervertebral

disc contents into the spinal canal. Degenerative bony changes and a buildup of pressure over time eventually produce a tear in the tough ligamentous fibers of the annulus fibrosus leading to extrusion of the contents of the nucleus pulposus, which in turn compresses or causes irritation of the exiting spinal nerve roots.

This condition is often misdiagnosed due to its polymorphic clinical presentation, which includes isolated arm and neck pain. The gold standard for the diagnosis of CDH is by the use of an MRI of the spine with or without contrast. Once the diagnosis is established, management options are considered. It is still controversial whether to pursue conservative or more aggressive surgical management early on.^[19] Consensus among providers is currently unavailable; however, a surgical approach is usually considered when there are significant neurological deficits, the presence of myelopathy, or rapidly progressing symptoms. Most providers usually begin management conservatively with neck immobilization, physical therapy, and pharmacologic pain management, with NSAIDs and muscle relaxants often used as first-line agents.

Although surgical intervention is not a guarantee of cure or even of improvement, patients should still be informed of the treatment options available for their condition, once it is accurately diagnosed. Our presently described patient did not achieve even modest pain relief while using conservative treatment, and her quality of life was disrupted to the point where she repeatedly presented to the emergency room for acute pain management.

Often, patients are managed by many physicians from different medical specialties and undergo numerous pain treatment approaches before being referred to the spine surgeon. This might also be a cause of delay in making the definitive diagnosis and pursuing surgical intervention.

Opioids are considered an effective method for acute and chronic pain control and may represent a transient bridge therapy for managing spinal pain, but they are not indicated routinely in all cases or for long-term use, and should be used exclusively in carefully selected patients. One of the reasons for prescribing opioids is that physicians feel obligated to achieve patients' satisfaction often at the price of side effects, which may be underestimated.^[12]

Opioid treatment or surgical intervention?

From history's earliest civilizations, first reference dating back to 3400 B.C. to today, societies have been struggling with balancing the medicinal properties of opiates in treating pain with the euphoric effects that have resulted in its misuse and abuse. In 1775, opium made its way to the US, creating at least three waves of opioid epidemics, not including those identified during the American Civil War and the early parts of the turn of the 20th century.

The first "modern" wave began in 1991, registering an increase in the number of deaths as a direct correlation with the increase

in prescriptions of opioid medications for the treatment of pain, including non cancer-related pain. By 1999, 86% of patients using opioids were using them for non cancer pain. This rise in prescription number was influenced by the reassurance from the pharmaceutical companies that the risk of addiction to prescription opioids was very low when used to manage "legitimate" type pain. This wave occurred despite ample evidence of the possibility of opioid addiction caused by opioid-derived substances used in the preceding years. As an example of mass opioid addiction was seen as long ago as 150 years, that being the widespread use of morphine, a derivative that is 10 times stronger than opium, as a painkiller during the U.S. Civil War. As a result, an estimated 400,000 soldiers became addicted. Morphine use was so rampant that it actually became known as "the Soldier's Disease."

In 2010, as a result of restricting opioid prescriptions, there was an increase in heroin abuse – a widely available, illegal opioid, which marked the second modern wave of opioid-related deaths.

The third wave of the modern epidemic began in 2013, as a consequence of an increase in consumption of synthetic opioids, such as synthetic fentanyl manufactured in China, leading to fentanyl-related deaths.^[5] In 2015, there were estimated 20,101 overdose deaths related to prescription pain relievers and 12,990 overdose deaths related to heroin.^[16]

Four in five new heroin users started out misusing prescription painkillers. From 1999 to 2008, overdose-related deaths, sales, and substance-use disorder treatment admissions related to prescription pain relievers increased in parallel.^[3]

The Council of Economic Advisors reported that, in 2015, the economic cost of the opioid crisis was \$504.0 billion. The total number of prescriptions in 2015 was estimated at 1,513,929.^[1,2]

In a recent report by Buchanich *et al.*, it was noted that individual states might be underestimating the effect of opioid-related deaths due to incomplete cause-of-death reporting. From 1999 to 2015, there were an estimated roughly 70,000 unspecified deaths that should have been marked as opioid related. This may indicate an opioid overdose crisis much worse than it appears.^[6] In addition to this, it should also be mentioned that over 65% of reported opioid overdoses were related to suicide attempts, based on nationwide data from the US Poison Control Centers. Many of the opioid overdoses presenting to emergency departments may be unrecognized suicide attempts, and probably over 66,000 deaths may indeed be completed suicides.^[20] There are still no statistical reports about the number of intrahospital opioid-related cardiac arrests.

The escalation of opioid use was based on a single observational study published in 1986 by Drs. Russell Portenoy and Kathleen Foley, suggesting that "opioid maintenance therapy can be a safe, salutary and more humane alternative to the options of surgery or no treatment in those patients with intractable non malignant pain and no history of drug abuse."^[15]

In 2019, we may suggest that surgery can actually be the “humane” treatment for appropriate candidates, as opposed to that of chronic opioid use, which proved to be unsafe in this present case.

Along with all the efforts to decrease opioid use for managing non cancer pain, implementing the recommendations for an earlier surgical correction, especially in cases of an obvious large sized disc herniation with nerve root compression, may be very beneficial. Insurance companies should consider approving surgery as an early treatment modality, without having patients go through exhaustive, long-term conservative management.

In the treatment recommendations for CDH, there is no mention of a certain arbitrary time limit for the use of opioid-based medication. Without having to mention that every patient has a different course of their pain condition, how long should we wait before we recommend surgical intervention?

In the Federation of State Medical Boards guideline regarding opioid treatment, one of the reasons to discontinue opioid therapy is “failure to achieve expected pain relief or functional improvement.” Another recommendation is to continually reevaluate the risks and benefits of opioid treatment in the course of the disease.^[4] What worked well for pain management previously may not work well currently, especially in surgical candidates like patients suffering from CDH-related radicular type pain due to nerve root compression.

The same recommendations are adopted by the United States Centers for Disease Control and Prevention: clinicians should evaluate the relative benefits and harms from treatment with patients within 1–4 weeks of starting opioid therapy for chronic pain or of dose escalation; they should evaluate the potential benefits and harms of continued therapy with patients every 3 months or more frequently. If benefits do not outweigh harms of continued opioid therapy, clinicians should optimize therapies and work with patients to taper opioids to lower dosages or to taper and discontinue opioids altogether.^[10]

A clear benefit of surgery over conservative treatment for CDH has not been demonstrated. Some studies suggest that prolonged conservative treatment will have comparable results as surgery on primary outcome, after 1 year of follow-up.^[18,19]

However, chronic opioid administration for pain management in cervical radiculopathy is not without risks, with major complications being analgesic tolerance, hyperalgesia, addiction, and overdose. We still oversee these complications when it comes to pursuing surgery for complete recovery. There are no studies published regarding the cutoff time point after which surgery demonstrates a better result, compared to long-term opioid use.

When surgery is not an option

For the management of acute pain, usually postoperatively, PCA is often used. The most commonly used drugs in these computer-based

self-delivery systems are morphine and hydromorphone. What is often not appreciated by health-care providers is that IV hydromorphone is 7.5–10 times more potent than morphine in IV preparations. Hence, patients are more prone to sedation, hypotension, respiratory events, and even cardiac arrest.

Hydromorphone induces analgesia through its potent action as an agonist at the $\mu 1$ and $\mu 2$ receptors, with $\mu 2$ receptors being responsible for respiratory and cardiac depression. Along with other opioids, hydromorphone can cause hypotension, including orthostatic hypotension and syncope.^[13]

In addition to the well-known dose-related side effects of respiratory depression and hypotension that can produce cardiac arrest, hydromorphone has intrinsic properties that increase that risk even further. The stimulation of delta-opioid receptors at the sinoatrial node may result in excessive vagal activation. This is a potential cause of prolonged sinus pauses in patients with no underlying cardiac conduction disease. These pauses are completely reversible on cessation of the use of hydromorphone.^[9,17]

Hydromorphone has also been reported to be associated with histamine release and, as a result, can cause significant decreases in systemic vascular resistance and blood pressure. This effect can be managed with the administration of H1 and H2 antagonists, vasopressors, and intravenous fluids.^[7]

The morbidity from these adverse drug events is largely preventable with the implementation of increased patient monitoring after the opioid is administered, even with PCA. There should be protocols in place, such as obtaining the patient’s vital signs every 2 h and monitoring pulse oximetry or end-tidal CO₂. Should a respiratory or cardiac arrest occur due to opioid overdose, a standard ACLS with supportive drugs such as epinephrine is needed. More importantly, however, naloxone needs to be a part of the resuscitation regimen. It is important to remember that naloxone has a half-life of 30–80 min, which is much shorter than most opioids that are used with PCA. Hence, repeated doses need to be given to prevent re-narcotization.

Another way of missing these events is during handoffs or transport to other locations after medication is given. Thus, handoffs must be standardized, and the patient monitored for adequate intervals before transport. Improvement will only be achieved with education and adequate staffing. In addition, bedside education for the family or immediate caregivers of these patients about the presentation of adverse reactions may play a role in the prevention of such events; in this case, the patient’s mother’s observation was crucial in saving this patient’s life.

Other sources of patient harm with these analgesics, especially hydromorphone, stem from the fact that they are administered by a computerized device, which must be programmed by the health-care professional, and errors may occur in programming, or via equipment failure or the ordering and transcription of the medication. Hence, one way to correct these errors would be to

educate providers about these commonly used narcotics, from the prescriber to the person that is administering the medication, and continually refresh that information. In terms of programming errors, it is important to have user-friendly systems and also fail-safe systems that allow the provider to cross-check the order before order submission and subsequent medication administration. These measures may be as simple as using a checkbox to confirm the order or an alert that would pop up when there is a deviation from the standardized protocol.

Finally, whenever starting opioids, start low and titrate to effect. Although the hydromorphone insert suggests starting at 1–2 mg, initial doses in opioid-naïve patients should be reduced to 0.2–0.6 mg every 2–3 h when given IV push. Ideally, a combination of all of the above strategies may prove effective in reducing the incidence of opioid side effects in the management of acute or postoperative pain. Further studies to elucidate this are still needed.

CONCLUSIONS

CDH can be treated conservatively in certain patients, but in cases of obviously large-sized symptomatic disc herniation or nerve root compression associated with neurological deficits, we recommend an early indication to surgical correction in lieu of opioid administration. It is difficult to estimate a certain arbitrary interval after which we should proceed to surgery, as this should be the patient's decision after taking into account all the risks and benefits of the surgical intervention, as well as that of chronic opioid administration. The shorter the interval of a given patient's opioid exposure, the better.

In cases when opioid administration is inevitable, especially for acute pain management, there should be an implementation of vigorous monitoring of the patient, handoffs must be standardized, and the patient monitored for adequate intervals before transport; education of staff and family members about potential side effects; and starting opioids at low dose and titrating to effect. These safety steps should be implemented to avoid life-threatening side effects of opioids such as respiratory depression and cardiac arrest.

Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent forms. In the form the patient(s) has/have given his/her/their consent for his/her/their images and other clinical information to be reported in the journal. The patients understand that their names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

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Conflicts of interest

There are no conflicts of interest.

REFERENCES

1. Available from: <http://www.clinical.com/DrugStats/Drugs/HydromorphoneHydrochloride>. [Last accessed on 24 Dec 2018].
2. Available from: http://www.painpolicy.wisc.edu/sites/default/files/country_files/hydromorphone/unitedstatesofamerica_hydromorphone.pdf. [Last accessed on 24 Dec 2018].
3. Available from: <https://www.asam.org/docs/default-source/advocacy/opioid-addiction-disease-facts-figures.pdf>. [Last accessed on 19 Dec 2018].
4. Available from: https://www.fsmb.org/siteassets/advocacy/policies/opioid_guidelines_as_adopted_april-2017_final.pdf. [Last accessed on 17 Dec 2018].
5. Available from: <https://www.poison.org/articles/opioid-epidemic-history-and-prescribing-patterns-182>. [Last accessed on 17 Dec 2018].
6. Buchianich JM, Balmert LC, Williams KE, Burke DS. The effect of incomplete death certificates on estimation of unintentional opioid-related overdose deaths in the United States, 1999-2015. *Public Health Rep* 2018;133:423-31.
7. Chen A, Ashburn MA. Cardiac effects of opioid therapy. *Pain Med* 2015;16 Suppl 1:S27-31.
8. D'Antoni A, Croft AC. Prevalence of herniated intervertebral discs of the cervical spine in asymptomatic subjects using MRI scans: A qualitative systematic review. *J Whiplash Relat Disord* 2005;5:5-13.
9. Deo SH, Barlow MA, Gonzalez L, Yoshishige D, Caffrey JL. Cholinergic location of δ -opioid receptors in canine atria and SA node. *Am J Physiol Heart Circ Physiol* 2008;294:H829-38.
10. Dowell D, Haegerich TM, Chou R. CDC guideline for prescribing opioids for chronic pain-United States, 2016. *JAMA* 2016;315:1624-45.
11. Fejer R, Kyvik KO, Hartvigsen J. The prevalence of neck pain in the world population: A systematic critical review of the literature. *Eur Spine J* 2006;15:834-48.
12. Ghaly RF, Aldrete JA. Critical look at the legalization of the liberal use of high-dose narcotics: Is this a reality? *Surg Neurol* 2005;64:480-1, discussion 481-2.
13. Guedes A, Papich M, Rude E, Rider M. Comparison of plasma histamine levels after intravenous administration of hydromorphone and morphine in dogs. *J Vet Pharm Ther* 2007;30:516-22.
14. Ngnitewe Massa R, Mesfin FB. Herniation, disc. 2018. [Last accessed on 2018 Oct 27].
15. Portenoy RK, Foley KM. Chronic use of opioid analgesics in non-malignant pain: Report of 38 cases. *Pain* 1986;25:171-86.
16. Rudd RA, Seth P, David F, Scholl L. Increases in drug and opioid-involved overdose deaths - United States, 2010-2015. *MMWR Morb Mortal Wkly Rep* 2016;65:1445-2.
17. Snarr BS, Rowley CP, Phan SV, Achanti A, Hendrix GH. Prolonged sinus pauses with hydromorphone in the absence of cardiac conduction disease. *South Med J* 2011;104:239-40.
18. van Geest S, Kuijper B, Oterdoom M, van den Hout W, Brand R, Stijnen T, *et al.* CASINO: Surgical or nonsurgical treatment for cervical radiculopathy, a randomised controlled trial. *BMC Musculoskelet Disord* 2014;15:129.
19. van Middelkoop M, Rubinstein SM, Ostelo R, van Tulder MW, Peul W, Koes BW, *et al.* Surgery versus conservative care for neck

pain: A systematic review. *Eur Spine J* 2013;22:87-95.

20. West NA, Severtson SG, Green JL, Dart RC. Trends in abuse and misuse of prescription opioids among older adults. *Drug Alcohol Depend* 2015;149:117-21.

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