

## Response of Refractory New Daily Persistent Headache to Intravenous Lidocaine Treatment in a Pediatric Patient

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### Abstract

New daily persistent headache (NDPH) is defined as a persistent and daily headache from onset. It is a unique headache that typically seen in people without a prior history of headaches. New daily persistent headache (NDPH) is an often medication-refractory headache disorder, currently classified as a primary headache disorder. Several medications including Onabotulinum toxin injections and sphenopalatine ganglion block are currently under investigation and may provide a potential new effective treatment regimen. IV lidocaine has been used for the management of chronic daily headaches, trigeminal autonomic cephalalgias, neuropathic pain, oro-facial, and postoperative pain. We administered IV lidocaine with successful treatment of headache in a refractory NDPH pediatric patient.

**Keywords:** New daily persistent headache; Intravenous lidocaine; Intractable headache; Intravenous dihydroergotamine; Chronic daily headaches

**Abbreviations:** ED: Emergency Department; NDPH: New Daily Persistent Headache; ICHD-3 beta: International Classification of Headache Disorders-beta; MRI: Magnetic Resonance Imaging

### Background

New daily persistent headache (NDPH) is described by the International classification of headache disorders-beta (ICHD-3 beta) as persistent headache fulfilling criteria B and C. Criteria B- Distinct and clearly remembered onset, with pain becoming continuous and unremitting within 24 hours, C- Present for >3 months, D- Not better accounted for by another ICHD-3 diagnosis [1-3]. NDPH was first described in a series of 45 patients by Vanast in 1986 [4] as a "benign syndrome, combining features of common migraine and tension headache and occurs daily from the first day the headache begins".

Lidocaine has often been used successfully to treat chronic pain disorders like neuropathic pain and intractable headaches refractory to other medications [5-8]. The exact mechanism of therapeutic action of lidocaine is yet to be agreed upon.

### Case Report

A 16-year-old previously healthy boy was diagnosed with NDPH in November of 2013. The headache was described as a severe, sharp and stabbing pain in the bi-temporal and frontal regions, associated with nausea and graded as a 7-9/10 intensity pain on a scale of 1-10 with 10 being the highest pain which was disrupting his life and resulting in missed school days. There was no positional component, head trauma, recent viral illness or any other triggering factor. There was no prior history of headaches and this headache was severe, continuous and unremitting from onset.

In October of 2013, he developed severe abdominal pain and vomiting that interfered with all aspects of his life. Extensive work up for the gastrointestinal pain included Computed tomography (CT scan) of abdomen and colonoscopy was of no clinical significance.

Laboratory data including complete blood count, complete metabolic panel, serum ferritin, erythrocyte sedimentation rate, C-reactive protein, thyroid function tests and EBV panel were all of no clinical significance. Lumbar puncture showed normal opening pressure with unremarkable studies. Brain Magnetic Resonance Imaging (MRI) in November 2013 reportedly showed a benign venous abnormality (DVO developmental venous abnormality) of unknown clinical significance with normal brain parenchyma and anatomy that was otherwise a normal study. Several failed medications for the constant daily headache were amitriptyline, nadolol, clonazepam, mexiletine, steroid taper, benztropine and propranolol. He was not on hydrocodone or any other opioid analgesics.

He was admitted to a comprehensive pediatric headache center where he received several medications to abort the headache including IV ketorolac with caffeine, hydroxyzine, magnesium sulfate, valproate, orphenadrine, metoclopramide, diphenhydramine, aprepitant, methergine, intravenous dihydroergotamine and IV ketamine. His headache did not respond to any of the medication and he was subsequently transferred to the tertiary care unit for intravenous lidocaine infusion.

Intravenous lidocaine 2 gm in Dextrose water (4 mg/ml) was initiated at 0.5 mg/min (1.2 gm of lidocaine in 4 hours) the first four hours and then increased to 1 mg/min (3.6 mg lidocaine). He was monitored using continuous telemetry during the infusion and experiences no side effects. In the first four hours the headache decreased in severity from 10/10 to 4/10 on the pain scale and after six hours the headache completely resolved. Total dose infused was 4.8 gm of Lidocaine. The patient reported that after months of daily and severe pain he was headache free for the first time in months. The IV lidocaine was continued for another 1 hour and was then stopped. At

the time of the discharge he was started on Zonisamide and the Nadolol was continued. At the 2 week follow-up post hospital discharge he reported resolved headache and return to regular school. At the 8 week follow-up post hospital discharge he reported 1-4 days of headache a month that was not debilitating. For almost 3 months after that he graded a headache pain range of 1-3/10 on the pain scale. These headaches were localized behind one eye and were of a migrainous nature with mild photophobia and nausea/vomiting.

## Discussion

NDPH is a form of primary headache and can present as a challenge to the primary care physician. It is unique in its presentation and course. Many patients who suffer from new daily persistent headache can state the exact date their headache began. When considering NDPH as a potential diagnosis a careful search for secondary causes for headache is warranted. At present, prognosis for new daily persistent headache is recognized as poor with very few available effective treatment options. Lidocaine blocks both initiation and conduction of nerve impulses by decreasing ionic flux through the neuronal membrane by blocking sodium channels, which results in local anesthesia. Lidocaine has a half-life of 1.5 to 2 hours and 2.5 hours in the elderly. It is hepatically metabolized and 98% renally excreted with a volume of distribution of 0.8-1.3 L/kg.

Lidocaine has been used as intranasal, intramuscular and suppository forms other than intravenous injections. Occipital, supratrochlear and supraorbital injections of IV lidocaine has been used for Chronic daily headaches (CDH) [6].

Lidocaine may be responsible for affecting the pain pathway by affecting central NMDA receptors or central and peripheral sodium channel [7]. When administered intravenously, lidocaine is also implicated in the rise of acetylcholine levels in the cerebrospinal fluid. This may lead to over stimulation of the inhibitory pain pathways and subsequent release of endogenous opioids [6].

The mechanism of analgesia after the discontinuation of the infusion long term is not clearly known- A study on rats to review the effect of lidocaine persisted 14-21 days, well beyond the half-life of the drug [9].

Marmura et al. studied 68 patients with CDH including 12 patients with NDPH between ages of 17-66 years (mean age 39 years) who were treated with 8.5 days of IV lidocaine 25.4% of patients exhibited a complete response, 57.1% exhibited a partial response, 3.2% worsened [7].

## Conclusion

Our case report is unique as this is the youngest patient to date at the age of 16 years old with NDPH who responded to IV lidocaine infusion.

With the limited treatment options available for NDPH further studies looking into the exact dose and duration of therapy as well as indications are required to determine a favorable duration of treatment along with the preferred dosage of lidocaine.

## Learning objectives

- NDPH is a severe daily headache that is an under recognized type of chronic daily headache. It is a diagnosis of exclusion after ancillary test is negative.
- It is refractory to medications usually and newer approaches may help with treatment as mentioned above.
- Think out of the box policy for complicated cases and refractory headache/pain disorders.

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