Teleneurology for Primary Headache Disorders

During the COVID-19 public health emergency, remote and in-person care for headache disorders is necessary to reduce patient risk.

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COVID-19 is a global pandemic causing a severe acute respiratory syndrome,[1] with massive morbidity and mortality worldwide. As we complete this article, over 5 million cases have been reported worldwide.[2] Social distancing is being recommended to reduce disease transmission, which has limited face-to-face health care. Individuals with headache disorders are particularly affected because of the consequent limited access to in-clinic procedures, including onabotulinumtoxinA, nerve blocks, trigger point injections, and emergency intravenous (IV) treatment for severe attacks. Although data is limited, there is some evidence for benefits of telemedicine for primary headache disorders.[3-5] Based on expert opinion and the available literature, this article reviews 6 clinical scenarios with a goal of optimizing the use of teleneurology for primary headache disorders during widespread adoption at the time of the COVID-19 pandemic.

Teleneurology Evaluation and Management

Many modalities are available for telemedicine, including synchronous audiovisual visits—now covered by Medicare and most commercial insurances in the US for new and established patient visits during the COVID-19 pandemic. Telemedicine should be treated as an in-person assessment for new or established patients. As in clinic, teleneurology visits can be used to gather history, perform a neurologic examination, and optimize patient care (Box 1 and 2). The major caveat is that parts of the neurologic examination are not possible with audiovisual telemedicine, including funduscopy, tone assessment, reflex testing, or Medical Research Council (MRC) strength testing.

Teleneurology provides an excellent modality for monitoring established patients for routine follow-up care or exacerbations, even outside of the COVID-19 pandemic. During the COVID-19 pandemic, it is wise to consider using primarily self-administered treatments (eg, oral or autoinjectible medications and neuromodulation devices) over those that require provider-administered injections (eg, onabotulinumtoxinA or nerve blocks) because of the limitations on access that are in place to reduce the risk of viral exposure. A recent review provides additional clinical pearls for managing headache with telemedicine.[6] Any treatment decision making must carefully address safety considerations (Box 2).

Status Migrainosus Treatment at Home

Status migrainosus is a migraine attack lasting more than 3 days, during which first-line acute treatment options (eg, triptans) often have not aborted the attack.[8]

First-Line Treatments

First-line emergency treatment for status migrainosus varies significantly by protocol, and may include: IV fluids,[9-11] antidopaminergic drugs, which can also have an antiemetic benefit (eg, IV prochlorperazine,[11,12] diphenhydramine),[13] nonsteroidal anti-inflammatory drugs (NSAIDs) (eg, IV ketorolac[15-17]), and IV dihydroergotamine (DHE).[9,17-24] With the exception of IV fluids, all of these options can be prescribed as oral, intranasal, or intramuscular (IM) treatments that can be self-administered at home. As prescribed in the emergency department (ED), a combination of these self-administered medications can be recommended to patients over several days as a first step in rescue management for use when their typical acute treatment options have been ineffective. Other early options to consider include several days of triptan, -ditan or -gepants with once or twice daily dosing (Table 1). There is limited to no evidence, however, to guide this suggested use other than borrowing from treatments used prophylactically during menstrual-related migraine with triptans (eg, frovatriptan.)[25]

Box 1. The Teleneurologic Examination

Vital Signs
Ask patients to have a thermometer, blood pressure machine, and scale at home to record vital signs for the visit whenever possible.

Mental Status and General Appearance
The assessment is similar to what is done in person. Ask the patient to have pen and paper available in case formal cognitive assessment is needed. The cognitive test can be held up to screen or screen sharing can be used.

Head and Neck Examination
Observe active neck range of movement, including pain radiation, abnormal lesions, and any surgical scars. Have patients indicate areas of allodynia based on their own assessment or by a family member with the clinician demonstrating which areas to check. Observe the presence or absence of cranial autonomic signs.

Cranial Nerve Examination
Cranial Nerve II (Optic). Although funduscopy is not possible, the optic nerve can still be examined. Use the camera to zoom in on patients' eyes or ask the patient to come close for observation of pupils. Use a flashlight or ask the patient to close then open their eyes to demonstrate pupil constriction and symmetry. Attempt to evaluate visual fields with finger counting in the 4 quadrants of the patient's screen or by using images, such as the NIH Stroke Scale picture or an Amsler grid shared on screen. Check red desaturation.

Cranial Nerves III, IV, and VI (Oculomotor, Trochlear, and Abducens). Although formally checking smooth pursuit or saccades can be difficult, the range of extraocular movements can be examined. Ask the patient to look up, down, right, and left. Note if there is nystagmus or other involuntary movements and check for the absence or presence of ptosis.

Cranial Nerve V (Trigeminal). Ask the patient to draw any sensory disturbance on their face with their finger. If a family member is present, show the family member where to check the 3 terminal branches (V1-V3, ophthalmic, maxillary, and mandibular) with a tissue or an ice cube. Check jaw opening and closing for muscle of mastication.

Cranial Nerve VII (Facial). Examine the facial nerve visually.

Cranial Nerve VIII (Vestibulocochlear). Document that the patient's hearing is intact to voice.

Cranial Nerves IX and X (Glossopharyngeal and Vagus). Comment on presence or absence of dysarthria or any other notable qualities of speech. Use the camera to zoom in on the patient or have them come in close to the camera or bring the camera to their mouth to check palate elevation.

Cranial Nerve XI (Accessory). Shrug and neck rotation can be assessed visually.

Cranial Nerve XII (Hypoglossal). Observe tongue movements along with absence of atrophy and fasciculations.

Motor Examination
Note the absence or presence of muscle atrophy and fasciculation. Although tone cannot be formally assessed, severe abnormalities (eg, flexion contractures or spastic gait) can be noted as absent. Strength cannot be graded with the MRC rating scale; instead check presence of antigravity movement with a 10-second arms drift or a 5-second leg drift. Look for symmetry of movement with arm roll for the satellite sign and fine finger movements. To test leg muscle strength, consider checking squat, single-legged jumps, toe walking, and heel walking. Reflexes, including plantar reflexes, cannot be assessed unless there is a clear clonic state. If there is concern about reflexes, an in-person evaluation ultimately will be needed.

Sensory Examination
As done for cranial nerve V, have a family member (or the patient, if needed) check sensation with light touch or an ice cube. Assess proprioception with sensory drift and the Romberg test. There is a risk of falls with the Romberg test. Consider the patient's mobility and safety. Ideally, have a family member present to provide support or catch. If that is not possible, consider performing the Romberg test near a wall or couch for anyone with a risk of falls. If the maneuver is unsafe, document as such and do not perform.

Coordination
Check for dysmetria in the arms by having patient touch their nose from outstretched arms. This can be further modified to touching chest instead, considering the public health recommendation to avoid touching the face during the pandemic. Test heel-to-shin and rapid alternating movements as in the in-person examination. View gait including tandem gait as per usual.

Vestibular Examination
Maneuvers for vestibular examination (head impulse test or Dix-Hallpike maneuver) cannot be done adequately via telemedicine.

Second-Line Treatment

Although evidence is again limited, when first-line rescue treatment does not abort a patient's attack, second-line options are often used, including IV magnesium (which can also be used as a first-line treatment),[26] IV antiseizure medications (eg, divalproex),[23,27,28] IV acetaminophen,[17,29] and additional use of antinausea medications (eg, IV ondansetron). Similar to first-line options, all of these medications are available orally and could be used in various combinations (Table 1). Nerve blocks or sphenopalatine ganglion blocks are often used in clinic as second-line treatment, but again the access is currently limited.[30,31] An alternative to consider is having a compounding pharmacy make a lidocaine 4% nasal spray that can be used up to 4 times/day.

Box 2. Addressing Safety

Pregnancy

Most medications and devices to treat migraine are not proven safe in pregnancy.

- Patients should use home pregnancy tests particularly
  - prior to initiation of valproate sodium or dihydroergotamine (DHE)
  - with all other therapies if an appropriate contraceptive method is not in place

Side Effects

As would be done in clinic, all medication side effects need to be considered and discussed during telemedicine visits.

- Take special care with sedative medications
  - Have fall precautions in place
  - Ensure patient understands contraindications to driving after taking the medication

Cardiovascular Risks

Discuss cardiovascular risk factors and avoid vasoconstrictive medication if present.

Avoid treatments with cardiac effects in anyone with cardiovascular risk, including but not limited to:

- potential for prolongation of the QTc interval with frequent use of prochlorperazine and ondansetron),[7]
- effects on the PR interval for verapamil
- arrhythmia in the setting of tricyclic antidepressants

In general, patients should have an ECG before starting any of the medications listed and have follow-up heart monitoring, both of which may be limited during the pandemic. As a result, these medications should be used with caution at this time.

Refractory Status Migrainosus

Individuals with refractory status migrainosus, who traditionally may have been admitted for more aggressive treatment, may not be able to access inpatient care during the pandemic. For alternatives, there is even less evidence, especially when converted to home equivalents, but options include some oral or IM antipsychotics (eg, ziprasidone).[32] Higher doses or frequency of first- and second-line options may also be considered. Off-label use based on expert opinion may also be tried, including muscle relaxants (eg, tizanidine), gabapentin and timolol eye drops (Table 1). Initiating treatment with an autoinjectable preventive monoclonal antibody treatment may be beneficial, especially because these can have benefit within the first month or even week of treatment; whereas oral preventives can take up to 3 months to reach efficacy.[33]

Safety

There are safety considerations to consider in the context of the COVID-19 pandemic. For example, at this time we are not recommending steroids as a first-line option because there are concerns of enhancing viral replication in anyone who has contracted the coronavirus.[34] Initially, there were theoretical

TABLE 1. STRATIFIED APPROACH TO AT-HOME MANAGEMENT OF STATUS MIGRAINOSUS[a]

Treatment	Dose	Formulation	Frequency
First-Line (individualize combination over 3 to 5 days)			
Hydration	8 ounces	oral	8/day
Prochlorperazine	10 mg	oral	3/day
Benadryl	25 mg	oral	3/day
Naproxen	500 mg	oral	2/day
Frovatriptan[b]	2.5 mg	oral	2/day
Naratriptan[b]	1-2.5 mg	oral	2/day
Ubrogepant	50-100 mg	oral	2/day
Rimegepant	75 mg	oral dissolving tablet	1/day
Lasmiditan[b]	50-100 mg	oral	1/day
Second-Line (individualize and combine over 3 to 5 days)			
Magnesium oxide	400-500 mg	oral	2/day
Divalproex[c]	250 mg	oral	3/day
Acetaminophen	1 g	oral	3/day
Ondansetron	4-8 mg	oral	3/day
Hydroxyzine	25 mg	oral	3/day
Lidocaine	4%	nasal spray	4/day
Dihyrdroergotamine[b] (DHE)	0.5 mg	intranasal	1 spray in each nostril, twice-15 min apart
Third-Line (alone or in combination with above)			
Erenumab, fremanezumab or galcanezumab	varies	intramuscular	quarterly injection
Ziprasidone	10-40 mg	intramuscular	1/day for 5 days
DHE[b] + antinausea	1 mg/mL	intramuscular	3/day for 5 days
Ketorolac	30 mg/mL	intramuscular	3/day for 3 days
Tizanidine	2-8 mg	oral	3/day for 3-7 days
Cyclobenzaprine	5 mg	oral	2/day for 3-7 days
Baclofen	5-10 mg	oral	3/day for 3-7 days
Gabapentin	100-300 mg	oral	3/day for 5-7 days
Timolol	0.25%	eyedrop	1 drop/eye for 5 days

[a] Consider cardiovascular risk factors; if present, avoid drugs with cardiovascular effects. [b] do not combine DHE, triptans or -ditans within 24 hours or use more than 3 mg DHE in 24 hrs. [c] If unable to rule out pregnancy, consider alternatives

concerns that NSAIDs could increase risks of COVID-19; however, at this time the WHO does not advise against them.[35]

Identifying Who Requires In-Person Evaluation

At this time, we more wary of sending people to the ED, even when they have concerning features for secondary headache, because of the risk of COVID-19. In-person assessments are extremely limited because many outpatient clinics are limiting face-to-face visits. However, there are certain red flags that still require urgent in-person assessment, emergency imaging, or other investigations (eg, lumbar puncture). Ultimately, how such cases are managed must be individualized based on the specific presentation and the resources available.

First-Time Thunderclap Headache

First time thunderclap headache needs urgent assessment in the ED, as always, because of the high morbidity and mortality of potential etiologies. Same-day emergency imaging is recommended, with admission, as needed, based on findings. Most medical centers have access to emergency imaging including outpatient imaging facilities. Recurrent thunderclap headache with high suspicion of reversible cerebral vasoconstriction syndrome (RCVS) also warrants urgent imaging.

Headache, Fever, and Mental Status Change

Headache with fever and mental status change that is concerning for meningitis or encephalitis requires ED assessment and treatment, as always.

New-Onset Neurologic Deficits

New onset neurologic deficits, including facial asymmetry, unilateral weakness, and speech difficulties are a medical emergency requiring acute stroke evaluation. Concern has been raised regarding reduced stroke presentations that may reflect individuals fear of exposure to the virus in the ED.[36] Encourage patients to be alert to the signs of stroke and seek emergency care if any signs of stroke are present.

Vision Loss

Vision loss that is concerning for fulminant idiopathic intracranial hypertension (IIH), giant cell arteritis (GCA), or any cause other than a visual aura of migraine requires emergency in-person assessment and management. If there is a strong suspicion of IIH, we recommend emergent in-person evaluation by a neuro-ophthalmologist to obtain funduscopy, visual fields, and ocular coherence tomography (OCT). Cerebrospinal fluid (CSF) pressure should also be checked emergently with lumbar puncture, because IIH can lead to irreversible vision loss. In the case of GCA, initiate steroid treatment at the time of suspicion to prevent irreversible vision loss and arrange for laboratory studies and a temporal artery biopsy to confirm the diagnosis. A new visual disturbance, including symptoms suggestive of prolonged visual aura, lasting more than 60 minutes, particularly in those with no history of aura or similar symptoms, should be treated as a medical emergency.

Medication Side Effects

Anaphylaxis, signs of airway compromise, and concern for Stevens-Johnson syndrome are true emergencies; send individuals with any of these to the emergency department or have them call 911. Manage other medication side effects, including rash or injection site reaction with telemedicine, using patient portals for patients to share photos or telemedicine visits.

Possible Cerebrospinal Fluid Leak

Management of a CSF leak causing spontaneous intracranial hypotension (SIH) is dependent on availability of radiology and anesthesiology for nonemergency procedures (eg, myelograms and blood patches). If these nonemergent procedures are unavailable and symptoms are not debilitating, provide conservative pharmaceutical management until further options are available and safe. Such measures could include the use of abdominal binders or encouraging increased fluid intake.

Headache in COVID-19

In a scoping review and meta-analysis of 61 studies, headache was reported in 12% of people with COVID-19.[37] This is a secondary headache due to systemic infection, although further studies are needed to determine both if COVID-19 can cause meningitis or encephalitis[38] and the true rate of headache in COVID-19.[39] We recommend screening all patients reporting new-onset headache or worsening of an existing headache disorder for COVID-19 symptoms because headache may be a presenting symptom. Follow current guidelines for COVID-19 treatment. Treat headache according to its phenotype, avoiding steroids at this time if possible. Future studies are needed to guide treatment.

OnabotulinumtoxinA Wearing Off

OnabotulinumtoxinA injections are a mainstay treatment for many people with chronic migraine; however, during the COVID-19 pandemic access has been limited by efforts to promote physical distancing for the safety of patients, healthcare workers, and the public.[40] Individuals who depend on onabotulinumtoxinA injections for chronic migraine management may experience wearing off with severe attacks if no other treatment is put in its place. Several strategies can be used until onabotulinumtoxinA therapy can be resumed.

- If not already in use, consider initiating a monoclonal antibody calcitonin gene-related peptide (CGRP) inhibitor.

- If erenumab 70 mg monthly is being used, consider increasing dose to 140 mg monthly.
- If an oral preventive is in use, consider a dose increase as tolerated to maximize benefit, while discussing potentially more toleration of side effects because the increased dose is temporary until routine treatment is reinitiated.
- Consider adding a neuromodulation device (eg, noninvasive vagal nerve stimulation, supraorbital transcutaneous stimulator, remote electrical neuromodulation device, or single-pulse transcranial magnetic stimulation), which can also be used for acute treatment without risk of medication-overuse complications or interactions with other drugs. Insurance coverage can be a limiting factor for neuromodulation, but this may be tolerable if use is time-limited.
- If the above options are not viable, consider adding a new oral preventive agent, potentially from a different class than other medications already in use; this can be continued when onabotulinumtoxinA is restarted or used only during this time as a bridge therapy.

Cluster Headache Attacks

Occipital nerve block with steroids is an evidence-based preventive treatment for cluster headache[41] that may also have limited access during the COVID-19 pandemic. Additionally, prolonged oral steroid use is not recommended because it can cause immunosuppression that may increase risks of COVID-19, based on data from other coronavirus-caused diseases. However, we recommend a thorough risk-benefit analysis for possible occipital nerve block with steroid given the limited systemic absorption with nerve blocks.[42,43] Fortunately, there are also alternative first-line treatments for cluster headache, including galcanezumab 300 mg monthly, noninvasive vagal nerve stimulation, or verapamil (provided patient has a normal ECG).[43] The American Headache Society published cluster headache treatment guidelines in 2016, which provide detailed evidence-based options for both acute and preventive treatment, including 100% oxygen (12-15 L/min through a nonrebreather face mask), which can be used liberally at this time. Other acute treatments include subcutaneous or intranasal sumatriptan, intranasal zolmitriptan, DHE (nasal or intramuscular), and lidocaine nasal spray.[41]

SEEDS of Success—Lifestyle Migraine Management

Even during a public health emergency, lifestyle optimization matters. In fact, being homebound or even quarantined may increase the difficulty of maintaining a usual routine, which can increase migraine severity. The uncertainty and fear of COVID-19 may also lead to increased anxiety and stress. We recommend counseling patients to use SEEDS for Success (Table 2).[44] Remember to make use of these for yourself to improve health and wellbeing during this stressful time!

TABLE 2. SEEDS OF SUCCESS: LIFESTYLE MANAGEMENT FOR MIGRAINE

Sleep	Too much or too little sleep are both triggers for migraine attacks. Consistency is key for healthy sleep. Encourage a routine bedtime and waketime and 7 to 8 hrs/night of sleep
Exercise	Exercise has been shown to have potentially long-term benefits for migraine. Staying active may help prevent deconditioning. Encourage the use of apps, websites, and other resources for at-home exercise. Consider walking outdoors with appropriate physical distancing or use of any existing home gym equipment. Encourage those who are not exercising to start slowly and gradually build up endurance
Eating and drinking	Ask about eating habits, which have changed for many people because of altered routines. Fasting may be a trigger for migraine attacks. Encourage people to eat 3 regular meals per day. Hydration is also key. Aim for the rule of 8 x 8 ounces/day and limit caffeine to <200 mg/day, remembering, however, that inconsistent daily caffeine intake may also trigger attacks
Diary	If a headache diary is not already in use, now is a great time to start. In a stoplight headache diary, red signifies headache days that prevent function, yellow signifies headache days that slow a person down, and green signifies headache days that do not limit function. Symbols can be used to note other headache features and treatment, including medication use and potential overuse
Stress management	Stress management is important for everyone, especially during a pandemic. Although accessing cognitive behavioral or other therapies may be difficult, there are apps and websites such as DawnBuse.com to guide mindfulness. These may also be of use at bedtime to promote healthy sleep.

Conclusion

During this global pandemic, many will continue to have moderate-to-severe disability secondary to migraine. Because of limits on usual in-clinic injection therapies this change could prompt ED visits that may increase the risk of viral transmission and community spread of COVID-19. Conversely, fear of COVID-19 may prevent people from seeking appropriate emergency care for a secondary headache. Careful identification of potential secondary causes of headache disorders can help guide patients in this uncertain time. When secondary causes are not present, proactive planning and early aggressive at-home management may help to abort status migrainosus. We hope the alternatives to in-clinic procedures presented will prove useful. We have recommended some tips for worrisome

scenarios, including how to safely assess new patients for red flags. Although the COVID-19 pandemic has suddenly and drastically changed how we practice headache medicine, there are many safe and effective methods for assessment and treatment of our patients during this public health emergency and time of physical distancing. ■

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