Management of Migraine, Tension-Type and Cluster Headaches in the Emergency Department

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Abstract

Headache is the fifth most common chief complaint in emergency departments in the United States, accounting for two million visits per year, or 2.2% of all visits to the ED. The role of the emergency physician is to expeditiously diagnose those headaches that threaten life or disability, while treating the pain of the others effectively and rapidly. A myriad of choices is now available for treatment of acute headache. Herein, we discuss three specific primary headache disorders- migraine, tension-type, and cluster headache, and discuss various diagnostic and therapeutic strategies appropriate for the emergency setting.

MeSH Words: primary headache disorder, migraine, tension-type headache, emergency department

Overview and epidemiology

Headache is the fifth most common chief complaint in emergency departments (EDs) in the United States, accounting for two million visits per year, or 2.2% of all visits to the ED [1, 2]. Nevertheless, from a population perspective, ED use for headache is arguably uncommon [3]. Many Americans do not see any healthcare provider for management of headache, and those who do are much more likely to visit a primary care physician [4]. Population-based data indicate that 94% of American migraineurs do not use the ED over the course of one year, 3% visit the ED once over the course of a year, and another 3% visit the ED more than once over a year [3]. Patients with episodic tension-type headache are less likely to use the ED whereas patients with chronic headache are more likely to do so [3].

To understand the role of the ED in headache management within the broader healthcare system, it is useful to know why patients might choose an ED for their headache care. One model proposes two reasons: "the first or worst syndrome" or "the last straw syndrome" [5]. The former is characterized by a headache sufficiently different from or more intense than any other so that it alarms the patient, and the

latter is characterized by recurrent headaches that cause the patient to become frustrated, and potentially complicated with concomitant psychiatric and medication overuse issues. Others divide headache-care seekers into three groups. The first group presents or is referred to the ED for a truly threatening headache: one associated with warning signs such as high fever, focal neurologic symptoms, or an altered sensorium or a thunderclap headache. These need to be in the ED for expedited work-up and treatment. This group has been well described in other reviews [6, 7]. The second group presents with new-onset headache or headache refractory to the usual therapies. In these cases, the headache is most likely attributable to a benign cause, although it might herald a malignant process. The patients may or may not require diagnostic work-up in an ED setting, but they are there and must be evaluated and treated. The final group of patients has episodic headache disorder and visits the ED because outpatient care is not available, has not been established, is too expensive, or is too difficult to access in alternate locales. When asked to explain why they used an ED, patients cited mainly unbearable pain and associated symptoms or an unreachable/inaccessible primary care provider [3]. Concern about the significance of the headache was cited by only one-fourth of the study participants [3].

In urban EDs serving socioeconomically depressed populations, healthcare access is a prominent issue. When the role of socioeconomic factors was examined in multivariate models, the most important predictor of ED use for management of headache was ED use for management of other ailments [3]. Lower income and lack of insurance were also associated with ED use [3]. Thus, for many patients with chronic headache disorders, ED use seems to be more dependent on factors not directly specific to the headache (s).

In well-functioning healthcare systems, visits to the ED are potentially divertible to alternate locales. Reversible factors associated with an ED visit for headache include high headache-related disability score (i.e., worse underlying migraine) and depression, though it is unclear if addressing these problems would result in fewer ED visits. From the perspective of the healthcare system, ED visits for acute exacerbations of chronic illness are best avoided, as they are often ineffective while their costs are high. Nevertheless, at present, few other settings offer expedited care 24 hours per day, seven days per week.

From the perspective of the patient, ED visits are undesirable because of the lengthy wait times and the bright, cold, noisy, and chaotic environment, both of which are antithetical to optimal migraine care. From the perspective of the ED, it makes sense to avoid or unload visits that will not result in admission to help combat the epidemic of ED overcrowding.

Although the vast majority of headache sufferers do not use the ED or do so infrequently [3], there is a small subset of patients who account for most of the visits. Using the ED as their primary source often results in suboptimal care because rarely is the focus of the emergency clinician the underlying chronic illness. Strategies to re-direct frequent ED visitors will be discussed below.

Classification

The role of the emergency physician is to expeditiously diagnose those headaches that threaten life or disability, while treating the pain of the others effectively and rapidly. Standard classifications divide headaches into organic headaches, which are secondary to an identifiable acute process, and primary headaches, which are acute episodic manifestations of an underlying headache disorder of unknown cause. Organic headaches may be further divided into malignant processes, which require specific diagnosis and treatment, such as tumor, aneurysmal subarachnoid hemorrhage, carotid artery dissection, bacterial meningitis, reversible cerebral vasoconstrictive syndrome (RCVS), and acute angle closure glaucoma, and more benign conditions that are usually viral in etiology. The commonly encountered primary headaches are migraine, tension-type headache, and cluster headache, all of which are acute manifestations of an underlying headache disorder. Some organic processes can mimic these more benign primary headache disorders.

The diagnostic criteria for the headache subtypes are presented in Table 1.

Table 1. Diagnostic Criteria for Headache Subtypes. From the International Classification of Headache Disorders, 2nd edition [8]

Migraine without aura

A. At least 5 attacks fulfilling criteria B–D
B. Headache attacks lasting 4–72 hours (untreated or unsuccessfully treated)
C. Headache has at least two of the following characteristics:
   1. unilateral location
   2. pulsating quality
   3. moderate or severe pain intensity
   4. aggravation by or causing avoidance of routine physical activity (e.g., walking or climbing stairs)
D. During headache at least one of the following:
   1. nausea and/or vomiting
   2. photophobia and phonophobia
E. Not attributed to another disorder

Typical aura with migraine headache

A. At least 2 attacks fulfilling criteria B-D
B. Aura consisting of at least one of the following, but no motor weakness:
   1. fully reversible visual symptoms including positive features (e.g., flickering lights, spots or lines) and/or negative features (i.e., loss of vision)
   2. fully reversible sensory symptoms including positive features (i.e., pins and needles) and/or negative features (i.e., numbness)
   3. fully reversible dysphasic speech disturbance
C. At least two of the following:
   1. homonymous visual symptoms and/or unilateral sensory symptoms
   2. at least one aura symptom develops gradually over $\geq$5 minutes and/or different aura symptoms occur in succession over $\geq$5 minutes
   3. each symptom last $\geq$5 and $\leq$60 minutes
D. Headache fulfilling criteria B-D for Migraine without aura begins during the aura or follows the aura within 60 minutes
E. Not attributed to another disorder

Episodic tension-type headache

A. At least 10 episodes fulfilling criteria B-D
B. Headache lasting from 30 minutes to 7 days
C. Headache has at least 2 of the following characteristics:
   1. bilateral location
   2. pressing/tightening (non-pulsating) quality
   3. mild or moderate intensity
   4. not aggravated by routine physical activity such as walking or climbing stairs
D. Both of the following:
   1. no nausea or vomiting (anorexia may occur)
   2. no more than one of these: photophobia or phonophobia
E. Not attributed to another disorder

Cluster headache

A. At least 5 attacks fulfilling criteria B-D
B. Severe or very severe unilateral orbital, supraorbital and/or temporal pain lasting 15-180 minutes if untreated
C. Headache is accompanied by at least 1 of the following:
   1. ipsilateral conjunctival injection and/or lacrimation
   2. ipsilateral nasal congestion and/or rhinorrhoea
   3. ipsilateral eyelid oedema
   4. ipsilateral forehead and facial sweating
   5. ipsilateral miosis and/or ptosis
   6. a sense of restlessness or agitation
D. Attacks have a frequency from 1 every other day to 8/day
E. Not attributed to another disorder

Migraine is the most common primary headache disorder encountered in the ED, though it is much less common than tension-type headache in the general population. Migraine often presents as a unilateral, throbbing headache associated with nausea, vomiting, or photo- and phonophobia. Visual and sensory aura phenomena may briefly precede the headache, as may longer-lasting premonitory symptoms such as yawning, mood and appetite changes [8]. It usually lasts 4 to 72 hours.

Tension-type headache is rarely severe or functionally disabling. It is defined by the absence of migraine-like criteria: Tension-type headaches are typically bilateral, non-throbbing, and described with such words as pressure, squeezing, or tightness [8].

Acute cluster headache is the most common of the trigeminal autonomic cephalalgias (TACs). It is characterized by excruciating peri- or retro-orbital pain accompanied by cranial autonomic symptoms such as a stuffed nostril, rhinorrhea, reddening of the eye, lacrimation, miosis, sweating of the forehead, or ptosis, all ipsilateral to the pain. It typically lasts 45-60 minutes and rarely more than 180 minutes; the pain may resolve by the time the patient presents to the ED. However, even though the pain has resolved, the emergency physicians should take care to diagnose and treat the patient, because the headache is likely to return within 24 hours [8].

The accurate diagnosis of headache type has long been considered essential to appropriate treatment and patient education. Two main iterations of the International Headache Society's International Classification of Headache Disorders [8, 9] have provided a standard upon which formal headache diagnoses can be grounded, while shorter screening devices such as ID Migraine and POUND (Table 2) have reasonable test characteristics to separate migraine from non-migraine primary headaches [10, 11]. However, the distinction has proven harder to implement in the acute setting. Patients are usually uncomfortable in the throes of an acute headache, which may preclude obtaining a detailed history. Furthermore, patients tend to remember their acute headaches as more intense than or different from previous ones, thereby limiting the usefulness of the headache history as a guide to classification. One study found that when strict criteria were applied in the ED, many patients did not fulfill the definition of any of the headache disorders, usually because they claimed the current headache was unlike any prior ones or because the acute headache had features characteristic of different headache types [12]. Complicating the classification process is the uncertain pathogenic role of rhinosinusitis and elevated blood pressure. Markedly elevated blood pressure or a rapid rise in blood pressure may indeed cause headache, but at what level the blood pressure is the cause of the headache rather than secondary to it is unclear. Clinical data on the efficacy of anti-hypertensive agents for the treatment of acute headache are sparse. They suggest that some anti-hypertensive agents may be migraine-specific as opposed to blood-pressure lowering. (For example, the angiotensin receptor blocker candesartan has been shown to be a reasonable preventive agent even in normotensive migraineurs [13].) It is not unreasonable to treat acute headaches associated with elevated blood pressure with standard analgesics. Similarly, it can be difficult to separate headaches attributable to acute rhinosinusitis from some of the primary headache disorders, particularly because migraine may co-exist with acute upper respiratory infections and because lacrimation and rhinorrhea may be a component of migraine, sinusitis, and some of the TACs [14, 15]. In general, the autonomic symptoms of sinus pathology and migraine are bilateral, whereas those associated with the TACs are usually ipsilateral to the pain. If the pain is due to an acute sinus infection, it is usually associated with fever, sinus tenderness, and bad smelling or tasting postnasal drip. This is an important diagnosis to make, and the patient must be treated properly and quickly. It is unlikely that chronic rhinosinusitis is a cause of acute headache [14, 15].

Table 2. Screening Instruments for Migraine

ID Migraine [10]
- You feel nauseated or sick to your stomach
- Your headache limits you from working, studying, or doing what you needed to do (at least 1 day in a 3-month period)
- Light bothers you (a lot more than when you don't have headaches)

Sensitivity of 0.81 (95% CI, 0.77 to 0.85) and a specificity of 0.75 (95% CI, 0.64 to0.84), relative to an IHS-based migraine diagnosis assigned by a headache specialist in a primary care setting.

POUNDING [11]
(Pulsatile quality; duration of 4-72 hours; Unilateral location; Nausea or vomiting; Disabling intensity)
- Is it a pulsating headache?
- Does the headache last between 4 and 72 hours without medication?
- Is it unilateral?
- Is there nausea?
- Is the headache disabling? (Disabling headaches are those that disrupt a patient's daily activities.)

If the patient answers "yes" to 4 or more of the 5 questions, the LR is 24 (95% CI, 1.5-388) (definite or possible migraine vs not migraine); for 3 criteria, the LR is 3.5 (95%CI, 1.3-9.2); and for 1 or 2 criteria, the LR is 0.41 (95% CI, 0.32-0.52).

Headache types that require emergency investigtion

Headache can be a symptom of a malignant process that threatens life or functionality, such as tumor, bacterial meningitis, or cerebrovascular disease. When patients present with a headache together with signs and symptoms of neurological impairment or meningismus, they often undergo extensive work-up until an accurate secondary headache diagnosis has been made. Therefore, these cases may be less of a diagnostic challenge. More difficult for emergency physicians is the diagnosis of subtle malignant headaches – the ones that present in a neurologically intact patient but require expedited diagnosis to ensure a normal neurologic outcome. In addition to bacterial meningitis, tumor, aneurysmal subarachnoid hemorrhage, carotid or vertebral artery dissection, cerebral venous sinus thrombosis, idiopathic intracranial hypertension (pseudotumor cerebri), temporal arteritis, and RCVS are all examples of diseases that may cause a warning headache prior to the onset of neurologic impairment. The greatest opportunity for benefit lies at this juncture.

How then to identify the patients who require a comprehensive diagnostic work-up in the ED? Some recommend performing brain imaging and lumbar puncture in all patients who present with "first, worst, or changed headache." [7] This conservative strategy is unlikely to miss subarachnoid hemorrhage, but it may lead to a high rate of over-testing. Clues to a malignant process may be sought on history and physical examination. For example, a thunderclap headache, which peaks in intensity within seconds of onset, is more likely to represent a malignant underlying process, whereas headaches that take longer than several minutes to peak are probably not due to subarachnoid hemorrhage [16]. Carotid dissection may present with the ptosis and miosis of Horner's syndrome, as the function of the sympathetic fibers that run with the carotid artery are also impaired [17]. The associated headache is often ipsilateral to the eye with Horner's syndrome and may be accompanied by neck pain. If carotid dissection is suspected, the emergency physician should review the history for recent Valsalva or minor neck trauma , although often these events are subtle or absent [17]. An occipital arteriovenous malformation can cause a contralateral aura mimicking visual disturbances that can continue for an hour or more. Cerebral venous sinus thrombosis usually presents in individuals with traditional thromboembolic risk factors or a recent head or neck infection. Idiopathic intracranial hypertension usually presents in young obese women with visual complaints and papilledema. Pituitary apoplexy may present with ophthalmoplegia or visual field cuts, though often patients are unaware that they have a pituitary adenoma [18]. Temporal arteritis presents in older patients with throbbing and tenderness in the temple, fever, proximal weakness, jaw claudication, and elevated erythrocyte sedimentation rate and C-reactive protein. RCVS presents with several episodes of thunderclap headache. It is noteworthy that headache relief after intake of non-steroidal anti-inflammatory medications, anti-emetics, or sumatriptan does not reliably rule out a malignant cause, as any headache process can improve after these medications [19, 20]. In general, a thoughtful and thorough approach is warranted in all patients with a de novo headache.

As with other high-stakes diagnoses in the ED, it may be possible to increase throughput and streamline care by creating a clinical protocol for headache management. Some data suggest that this would decrease consultation, increase the use of appropriate testing, and standardize treatment [21], particularly when department practitioners originate from a variety of training backgrounds with different expertise.

Treatment of acute headache

Thanks to the myriad of treatment choices now available for acute headache, emergency physicians have the luxury of weighing the diagnoses, medication side-effect profiles, contraindications, and previous experience of the patient. Physicians should aim for providing patients with immediate relief, returning them to a high level of functioning so that they can drive home or return to work, and minimizing the likelihood of headache recurrence after ED discharge. An additional consideration is route of therapy. In patients who can tolerate and are likely to respond to oral medciation, it is not unreasonable to dispense one tablet or offer the patient a suppository rather than an invasive method such as an injection or intravenous catheter. In sicker patients with nausea and vomiting, the gastrointestinal tract needs to be bypassed, so oral medications are inappropriate. Although the intravenous route may provide better or more rapid relief, it can also delay discharge.

Ideally, in headache management, the emergency physician arrives at the correct diagnosis and initiates treatment in the ED on the basis of the severity of the underlying disease or through a series of incremental steps. However, the difficulty in accurately categorizing acute headache in the emergency setting combined with the efficacy of many agents across a range of primary headache disorders decreases the importance of reaching a specific diagnosis prior to treatment. For example, migraine, cluster, and at times tension-type headache all respond to triptans and dihydroergotamine (DHE), and migraine and tension-type headaches are likely to respond to anti-emetic/dopamine-antagonists and non-steroidal anti-inflammatory drugs (NSAIDs). In the section below, we will discuss the role of different headache medications over several specific headache types.

Triptans

Now a mainstay of migraine therapy, triptans act as agonists of serotonin 1B/1D receptors within the trigeminovascular system. They disrupt the nociceptive pathway of an acute migraine and thereby relieve the pain. Current thinking is that triptans exert both an anti-inflammatory effect, by blocking the release of calcitonin gene-related peptide (CGRP) and substance P, as well as a vasoconstrictive effect [22]. Sumatriptan is the prototypical agent within this class and still the only one available in injectable form. Two decades of experience with sumatriptan, in addition to numerous clinical trials, have demonstrated its safety and efficacy. In the ED setting, subcutaneous sumatriptan was found to substantially outperform placebo in patients with acute migraine, with a number needed to treat of 2.5 and a median time to meaningful relief of 34 minutes [23]. Meta-analysis of outpatient trials of acute migraine yielded a similar efficacy, with a number needed to treat of 2 [24]. Subcutaneous sumatriptan is burdened by a high rate of unpleasant effects, with a number needed to harm of 4. Furthermore, headaches recur after ED discharge in approximately two-thirds of patients [23]. Sumatriptan should not be used in patients with uncontrolled hypertension or cardiovascular risk factors. It is ideally dosed at 6 mg; a dose of 4 mg may decrease the rate of side effects, while higher doses, and second doses, are probably not more effective [25, 26]. Sumatriptan is less likely to be effective in patients with a migraine duration of more than several hours or patients with allodynia (increased sensitivity to normally non-noxious stimuli) [27].

Rizatriptan and zolmitriptan are available as orally disintegrating tablets, which may be useful in patients who cannot tolerate swallowing a tablet or drinking fluid. There are seven triptans in oral formulations; doses are listed in Table 3. Sumatriptan and zolmitriptan are available as nasal sprays. There will likely be a sumatripan patch in the future. A substantial number of patients who present to urban EDs with acute headache have not taken any prior medication, and in these cases, the administration of one oral triptan tablet is not unreasonable.

Based on limited data suggesting sumatriptan may also be effective in patients with acute

tension-type headache in the ED setting [28], it may be administered for this indication, particularly in the presence of a history of underlying migraine disorder or if the headache has some migrainous features. Similarly, acute cluster headaches are likely to respond to subcutaneous sumatriptan [29] and to triptan nasal sprays [30, 31]. Sumatriptan is not considered safe in pregnancy; however, registry data so far have not revealed teratogenicity and the drug is frequently used in Europe.

Table 3. Dosages of Triptans
For maximal efficacy, triptans should be administered early in the headache course.

Generic name	Brand name	Dose/ route of administration
Almotriptan	Axert, Almogran	Tablets: 6.25mg, 12.5mg
Eletriptan	Relpax	Tablets: 20mg, 40mg
Frovatriptan	Frova	Tablets: 2.5mg
Naratriptan	Amerge	Tablets: 2.5mg
Rizatriptan	Maxalt, Rizaliv, Rizalt	Tablets: 5mg, 10mg Orally disintegrating tablets: 5, 10mg
Sumatriptan	Imitrex, Treximet (sumatriptan + naproxen), Imigran, Imigran recovery	Tablets: 25mg, 50mg, 100mg Nasal spray: 5, 20mg Injection: 4mg, 6mg subcutaneously Treximet tablets: sumatriptan 85 mg + naproxen sodium 500 mg
Zolmitriptan	Zomig, Zomigon, AscoTop, Zomigoro	Tablets 2.5mg, 5mg Nasal spray: 5mg Orally disintegrating tablets: 2.5mg, 5mg Comparable efficacy to droperidol

Dihydroergotamine (DHE)

Ergotamine tartrate is an ancient therapy not commonly used in the United States today. It is more tolerable in its dihydrogenated, reduced form, dihydroergotamine [32]. The mechanism of action, like for triptans, probably involves the disruption of nociception within the trigeminovascular system. DHE also stimulates serotonin receptors. With the advent of sumatriptan, the role of DHE in the acute management of migraine has diminished. It has a similar side effect profile as sumatriptan, with the same contraindications. DHE has a lesser initial effectiveness than sumatriptan but it is less likely to be associated with migraine recurrence after discharge [33]. It is traditionally administered as a slow intravenous drip of 0.5-1.0mg. An anti-emetic is usually given first to prevent the frequent occurrence of nausea; this combination also appeared to enhance effectiveness in clinical trials. If DHE is given as an intramuscular injection, the risk of nausea is lower, so this route might be preferable if the migraine is prolonged and accompanied by central sensitization and allodynia. DHE will likely be available in an oral inhaler in the future for home use, with little loss of effectiveness relative to an intravenous administration.

Anti-emetic/dopamine antagonists

Anti-emetics/dopamine antagonists were first reported to have an anti-migraine effect in the early 1970s [34]. The mechanism of action is still not understood, but is probably related to dopamine-receptor blockade at the level of the trigeminal nucleus caudalis [35]. Extensive migraine-related data exist for droperidol [36, 37], prochlorperazine[38, 39], chlorpromazine

[40-42], and metoclopramide [43, 44]; there are also some data on methotrimeprazine [45], trimethobenzamide [46], and haloperidol [47]. Recommended doses are presented in Table 4 [36,37,40-43,48-51]. All these medications may induce acute, self-limited akathisia, particularly after a rapid intravenous bolus, so prophylaxis with an anti-cholinergic such as diphenhydramine may be warranted [52, 53]. The efficacy of this class of medication extends to tension-type headache [48, 49], and limited data suggest a benefit also for acute cluster headaches [50]. Metoclopramide has a favorable pregnancy rating and may be considered a first-line therapy in pregnant patients with acute headache.

Table 4. Dosages of Dopamine Antagonists

Name	Dose/ route of administration	Efficacy data	Cautions
Commonly used			
Chlorpromazine [40-42, 68-70]	0.1mg/kg IV	High quality placebo controlled and comparative efficacy trials	Orthostatic hypotension, akathisia
Droperidol [36, 37]	2.5mg IV, 2.75mg IM	High quality placebo controlled and comparative efficacy trials	qt prolongation, akathisia
Metoclopramide[43, 44]	10-80mg intravenous drip	High quality comparative efficacy trials and meta-analysis	Akathisia
Prochlorperazine [38, 39]	10mg intravenous drip	High quality placebo controlled and comparative efficacy trials	Akathisia
Less commonly used			
Olanzapine [71]	10mg intramuscular injection	1 small high quality RCT demonstrating comparable efficacy to droperidol	
Haloperidol [47]	5mg intravenous drip	Small placebo controlled trial	

Parenteral non-steroidal anti-inflammatory medication

Intravenous or intramuscular ketorolac is considered a first-line therapy for tension-type headache. It also has well-established efficacy for acute migraine. NSAIDs may be administered in combination with any of the therapies discussed above, especially in prevention of recurrent headaches.

Opioids

Opioids have long been go-to agents in the management of acute severe migraine, and they continue to play a dominant role in the emergency setting despite the increasing availability of more effective alternatives. The various arguments against opioids, listed below, are prominent within the headache medicine community, although there is only weak evidence supporting them.

--Less effectiveness. Meperidine (pethidine) is less effective for the treatment of acute headache than DHE, triptans, and anti-emetic dopamine antagonists [51]. There is minimal comparative data for parenteral morphine or hydromorphone in acute migraine. Intuitively, opioids seem less appropriate treatment when the goal is to return the patient to work as soon as possible, as they often prolong functional disability.

--Higher likelihood of recurrence. Limited clinical data indicate that headache symptoms are more prone to recur in patients who receive parenteral opioids than in patients given alternative therapies [51, 52]. Because opioids do not affect the underlying migraine process, the patient often awakens with the same headache.

--Risk of induction of euphoria. Euphoria due to opioid use may be the reason for frequent return visits to the emergency room., and the potential for secondary gain and substance abuse is well described.

--**Chronification of migraine**. Patients with episodic migraine (<15 days per month) who are treated with opioids (or barbiturates) may be at increased risk of greater headache frequency or chronic migraine (>15 days per month) in later years [53]. In addition, use of opioid therapy in the emergency setting has been linked to migraine attacks that are more refractory to standard treatment in later years [54]. Owing to these concerns, opioids have been relegated to second-line treatment for acute migraine. They may play a more important role for some patients, but should be used rarely and judiciously, and should not be offered as initial therapy in patients with new-onset migraine.

A more difficult problem is how to address patients who expect to be treated with opioids in the ED. Those who are averse to change may be given opioids as early rescue therapy or in conjunction with a more standard first-line therapy. It is important that clinicians rule out the presence of chronic disease and screen for psychiatric problems and medication over-use. They should also see to it that the patient receives adequate outpatient follow-up and has access to a physician who specializes in complex migraine with co-morbidities. Caring for frequent ED users can be frustrating for the emergency clinician. On the one hand, the clinician is loath to ignore the suffering caused by acute pain; on the other hand, permitting or enabling a reliance on opioids does the patient and physician some disservice. Studies have shown that comprehensive multi-disciplinary interventions using a variety of resources to educate and adequately treat frequent ED users with acute migraine yields a modest benefit in motivated patients [55, 56]. In difficult cases, clinicians may use patient contacts to encourage adequate preventive care on an outpatient basis. Patient-specific plans of action may be appropriate, so that individual patients are dealt with uniformly by all members of a particular hospital's staff. These practices can be developed in conjunction with appropriate consulting services. If this is done away from the heat of battle, and applied correctly, it will make the experience more rewarding for the clinician and result in better-quality treatment for the patient.

Disease-specific interventions

Magnesium, dosed as a 2 gm intravenous drip, may be useful as a second-line therapy, particularly in patients with migraine with aura [57] and pregnant patients. Valproic acid, dosed as a 500mg - 1gram intravenous drip, has shown promise in open-label trials, though it has yet to show benefit in rigorous clinical trials [58-60]. Intravenous caffeine may be of benefit, but no clinical data have been published. Greater occipital nerve blocks with or without a steroid and a long-acting regional anesthetic may provide relief for some patients with acute migraine [61].

Oxygen is a long-standing and well-established therapy for acute cluster headache [62, 63]. It should be administered through a non-rebreathing mask at 7-10 l per minute. If that is not helpful, 15 l per minute should be tried for about 15 minutes. The patient should sit on a chair or bed and bend forward while breathing normally through the nose and mouth. On occasion, the cluster returns when the oxygen is removed.

Post-ED care

Regardless of the type of headache, its recurrence or persistence of headache after ED discharge is not unusual. Approximately one-third of migraineurs and 19% of patients with tension-type headache will have a moderate or severe headache within 24 hours of discharge [64]. It is often difficult to predict who will have a recurrence, though patients who are not pain-free at discharge or have a history of headache recurrence may be at greater risk. Evidence-based strategies to combat post-discharge headache are lacking. Dexamethasone has a small benefit, though with a number needed to treat of nine, clinicians need to weigh it against the potential harm [65]. One possible option is to provide the patient with disease-appropriate therapy, such as a non-steroidal anti-inflammatory agent or triptans for migraine or a non-steroidal anti-inflammatory for tension-type headache to take on an as-needed basis.

In patients with cluster headaches, it is important to recognize that daily or multiple daily recurrences for an extended period of time (4-8 weeks) is part of the natural history of the disease. In these cases, the clinician should consider starting the patient on transitional and maintenance therapy, and to provide him or her with prescriptions for subcutaneous sumatriptan, oxygen, or both for home self-management.

Although corticosteroids are often recommended as transitional treatment for cluster headache, the evidence for this is underwhelming. High doses of prednisone may be tapered over a week to ten days. Verapamil has been shown to be effective in preventing cluster headache starting at doses of 240mg daily and gradually doubling the dose. Patients may ultimately need much higher doses [66]. If rapid follow-up with a headache specialist cannot be ensured, these medications should be initiated in the ED.

Medication-overuse headache

Frequent use of simple or combination analgesics, butalbital-containing medications, opioids, caffeine, or migraine-specific medication, such as triptan, may exacerbate and chronify an episodic headache disorder. A complete headache history must include an assessment of frequency of acute medication use and the temporal relationship of medication use to an acceleration in headache attack frequency. Patients who use acute medication for headache more than two days per week are candidates for education and preventive medication, and should be referred to an outpatient physician. Patients with increasing headache frequency who overuse acute medication should be encouraged to stop the offending agent and initiate an alternative therapy [67]. A plan should be offered, either in the ED or an outpatient setting.

Status migrainosus/intractable headache

Status migrainosus is a debilitating migraine that does not remit for more than 72 hours despite appropriate therapy. DHE and steroids are often effective, although no treatment regimen is approved by the FDA. Given the wide range of medications available, it is now rare that relief cannot be afforded in the ED; however, it may take some time and may best be accomplished within the more comprehensive and quieter confines of an inpatient setting. In some patients, concomitant psychiatric and medication overuse issues may prove difficult to address adequately in the acute or out-patient setting.

Conclusion

Headache is a common chief complaint in the emergency department. The emergency physician should exclude malignant secondary causes and then treat the acute pain expeditiously and effectively. For migraine, triptans, DHE, intravenous anti-emetic dopamine antagonists, and NSAIDs are all reasonable first-line therapies. Opioids are best avoided. Tension-type headache may be treated with non-steroidal agents or anti-emetic dopamine antagonists. Acute cluster headaches are best treated with high-flow oxygen and parenteral sumatriptan. Regardless of the headache diagnosis, the emergency physician should be attuned to the likelihood of headache recurrence after ED discharge.

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