Chapter 4
Other Primary Headaches Commonly Seen in Pediatrics (Tension Type, Cluster, TACs)

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Case #1
A 13-year-old girl presents to her pediatrician for her yearly well-child check. Upon review of systems, she indicates that she has been having headaches for the last year at an average frequency of once per week. Upon further questioning, she describes the pain as a pressure-like sensation most prominent in the temple areas bilaterally, with extension in a band-like pattern around the entire head, a 3 out of 10 on a pain scale, typically lasting for 30–60 min. She denies associated nausea, vomiting, photophobia, or phonophobia. She has not missed any school or activities due to the headaches. The headaches typically occur on school days, and she notes that they greatly improved over the summer. On examination, she has normal vital signs including a normal-for-age blood pressure and normal body mass index. Her general health examination is normal, as are her neurologic and funduscopic examinations.

Case #2
A 17-year-old young man presents to his primary care physician for evaluation of headaches. He reports that he is having episodes of intermittent severe headaches lasting for 1 week at a time. He describes that during the week, he will have between 1 and 5 discrete headaches per day, each lasting for about 20 min with resolution in between. The head pain is described as 10 out of 10 on a pain scale, located around his right eye, with associated redness and tearing of that eye. He feels agitated during the episodes and is unable to participate in normal daily activities during the headache. He brings pictures of his face during an attack, and the pictures reveal right-eye injection with tearing, and the physician also notices ptosis of the right eyelid evident in the photographs. His last headache episode was 2 weeks ago. He

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recalls having had 7 such attacks occurring approximately every 4 months. On examination, he has normal vital signs including a normal blood pressure and body mass index. His general examination is normal, as are his neurologic and funduscopic examinations. Of note, there is no cranial nerve deficit seen on examination.

Case #3
A 16-year-old young man presents to his pediatrician for evaluation of headaches. He reports having two attacks per year of severe debilitating headaches. When these attacks occur, he will have severe left orbital pain lasting for 5 min, which recurs a total of 10 times per day with resolution in between episodes. He feels agitated when this occurs and describes the pain as a 10 out of 10 on a pain scale. He has associated swelling of the left forehead, and when he has looked in the mirror during an attack, his left pupil was smaller than the right. The episode will go on like this for an average of 2 weeks and then typically does not recur again until 6 months later. On examination, he has normal vital signs including a normal blood pressure and body mass index. His general examination is normal, as are his neurologic and funduscopic examinations.

Tension-Type Headache

Tension-type headache is likely to be underreported and many times is brought up during routine checkups. With a prevalence over a lifetime of between 30 and 78% and with impacts on quality of life, tension-type headache is an important diagnosis to recognize and treat [1]. Patients with chronic tension-type headache require particular attention, because it is in this group of patients that quality of life suffers. In addition to headaches, these patients have a higher risk of generalized hyperalgesia and lowered pain threshold, which seems to stem from central sensitization of pain pathways over time [2].

As defined by the International Classification of Headache Disorders third edition (ICHD-3), infrequent tension-type headache is diagnosed by meeting the following criteria:

A. At least 10 episodes of headache occurring on <1 day/month on average (<12 days/year) and fulfilling criteria B–D
B. Lasting from 30 min to 7 days
C. At least two of the following four characteristics:
1. Bilateral location
2. Pressing or 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
2. No more than one of photophobia or phonophobia
E. Not better accounted for by another ICHD-3 diagnosis

Based on the frequency and chronicity of the headaches, tension-type headache can be categorized into infrequent episodic (as above), frequent episodic, or chronic tension-type headache and further subcategorized into those with pericranial tenderness and those without.

The pathophysiology behind tension-type headache is not fully known but is thought to be due in part to peripheral myofascial tension in the head and neck regions, leading to hyperexcitability of the peripheral nerves [3]. Many patients with tension-type headache have pericranial tenderness on examination. It is postulated that repetitive nociceptive signals from the head and neck muscles lead to central sensitization of the nerves at the level of the trigeminal nucleus and/or the dorsal horn of the spinal cord, ultimately contributing to the altered pain tolerance and hyperalgesia seen in patients with tension-type headache [4]. Central sensitization of nociceptive pathways leading to head pain is supported by research done on neurotransmitters such as nitric oxide (NO), calcitonin gene-related peptide (CGRP), substance P, vasoactive intestinal polypeptide (VIP), and neuropeptide Y.

Spinal pain pathway sensitization as well as activation of periarterial sensory nerves leading to arterial dilatation have been associated with release of NO [3]. The role of NO in head pain pathophysiology is further supported by studies showing that patients with chronic tension-type headache who received a nitric oxide synthase inhibitor had reduced head and neck tenderness and reduced headache while those receiving a nitric oxide donor had headaches triggered [5–7]. The triggering of a delayed headache after NO donor administration that was seen in patients with chronic tension-type headache was much less likely in healthy controls, thereby suggesting that patients with a baseline amount of central sensitization to pain are at higher risk of the pain-inducing effects of NO [7].

Calcitonin gene-related peptide (CGRP) is a neuropeptide that has gained recent attention with the advent of CGRP blocking agents for the treatment of migraine. CGRP levels have been shown to be elevated in patients with migraine [8]. In contrast, patients with tension-type headache have normal CGRP levels as well as normal levels of other neuropeptides (substance P, vasoactive intestinal polypeptide (VIP), and neuropeptide Y) [9, 10].

The treatment of tension-type headache mirrors the treatment used for migraine. Of paramount importance is addressing and modifying suboptimal lifestyle factors. Patients should be counseled on the importance of these factors in treating their headaches and empowered to do so. While lifestyle modifications will be touched on here, they will be reviewed in greater detail in Sect. 4.4.

Sleep disturbance is a common comorbid concern in patients with headache syndromes. The patient should be counseled on the optimal age-appropriate sleep duration, developing and maintaining a bedtime routine and appropriate bed and wake times, avoiding frequent daytime napping, and avoiding afternoon caffeine. The clinician should also inquire about snoring, nighttime awakenings, and how refreshed the patient feels after a full-night sleep in order to screen for sleep apnea.

Optimal hydration, nutrition, and exercise as well as avoiding caffeine overuse are also important in the treatment of headaches. Hydration with mainly water should be optimized, and we suggest utilizing a urination frequency and quality goal in order to assure that good hydration is being met. We routinely counsel patients to drink as much water as is needed to produce at least 6 urinations per day and to aim for clear/light urine color. We like this approach rather than simply setting a goal of how many ounces per day to drink since it will account for differences in physical activity (for example, a hot day spent exercising outside would require more water intake than a cool day spent relaxing indoors). Optimal nutrition should also be emphasized. This includes eating regular meals and avoiding skipping meals, eating a healthy variety of foods, and weight management if needed. Routine cardiovascular exercise is also recommended, and we try to provide an attainable goal of 20–30 min 3 times per week. Caffeine should be avoided in excess and particularly in the afternoon hours as this may interfere with sleep.

Given that pain and mood oftentimes affect each other, stress management and addressing comorbid mood disorders are essential in treating headaches. It may be helpful to employ the use of validated depression and anxiety screening questionnaires in order to uncover these concerns. Once recognized, assuring that the patient gains access to the mental health services they need is important. In the treatment of migraine, certain types of psychological therapies, including cognitive behavioral therapy and biofeedback therapy, have been shown to be useful for pain control, and these may be used if appropriate in other headache types as well.

There are multiple complementary and alternative treatments that may be used to treat primary headache syndromes including tension-type headache, such as but not limited to physical therapy, massage therapy, craniosacral therapy, and acupuncture, where appropriate. The risks and benefits of these types of therapies should be discussed with the patient and caregiver. Further review of complementary and alternative treatments can be seen in Sect. 4.4.

Medications are used to treat tension-type headache when the headache burden is high or when lifestyle modifications have not provided enough benefit. Though most of the literature support for medications and vitamin supplements to treat headache comes from migraine studies, these same medications and vitamin supplements may be used to treat tension-type headache. Which medication or vitamin to choose is often a decision made based on the desired side effect profile. For example, a patient with difficulty falling asleep may benefit from amitriptyline or gabapentin, while a patient with obesity may benefit from topiramate. Pharmacological interventions will be further reviewed in greater detail in Sect. 4.4.

Trigeminal Autonomic Cephalalgias (TACs)

The trigeminal autonomic cephalalgias are a group of primary headache syndromes that are unilateral with associated predominant parasympathetic autonomic symptoms ipsilateral to the head pain. Given the differential diagnosis that should be considered

in this group of patients, it is recommended to obtain brain imaging with MRI brain and, depending on the type of TAC, to also obtain MRA head and neck, MRV head, and/or special sequences through the pituitary and cavernous sinus regions [11]. Treatment of this group of headache syndromes should still focus on lifestyle modifications as reviewed above, but there are some specific treatment recommendations pertaining to TACs, which we will also review below. The reader should keep in mind that since the TACs tend to be adult-onset disorders, most of the literature pertaining to treatment comes from adult studies rather than pediatric studies.

Cluster Headache

Of the TACs, cluster headache is the most common though still overall quite rare (only 0.1% prevalence in adults) with a male predominance of 3–4:1 and typically starting in the 20s or 30s [12].

As defined by the ICHD-3, cluster headache is diagnosed by meeting the following criteria [1]:

A. At least five attacks fulfilling criteria B–D
B. Severe or very severe unilateral orbital, supraorbital, and/or temporal pain lasting for 15–180 min (when untreated)
C. Either or both of the following:
1. At least one of the following symptoms or signs, ipsilateral to the headache:
• Conjunctival injection and/or lacrimation
• Nasal congestion and/or rhinorrhea
• Eyelid edema
• Forehead and facial sweating
• Miosis and/or ptosis
2. A sense of restlessness or agitation
D. Occurring with a frequency between one every other day and 8 per day
E. Not better accounted for by another ICHD-3 diagnosis

The differential diagnosis of cluster headache is wide and includes other primary headache syndromes that can mimic cluster headache, but also importantly includes causes of secondary headache, such as tooth impaction, acute-angle glaucoma, sinusitis, temporal arteritis, Tolosa-Hunt syndrome, trigeminal neuralgia, malignancy (pituitary tumors among others), cerebrovascular events such as dissection or infarction, and obstructive sleep apnea. For this reason, an MRI brain with specific pituitary and cavernous sinus sequences is recommended, and an MRA of the head and neck should be considered. In addition, an evaluation for sleep apnea should be considered in appropriate patients [11].

Typically, cluster headache attacks occur for weeks to months at a time followed by a period of remission, though patients with chronic cluster headache may not have times of remission. Cluster headache has a few features that if present in the

patient history can help the clinician distinguish it from other primary headache syndromes. It has typical triggers of alcohol consumption, histamine release, or nitroglycerin consumption and often responds to high-flow oxygen administration [1].

The pathophysiology of cluster headache is thought to involve the autonomic fibers of the trigeminovascular system as well as the hypothalamus. The autonomic fibers account for the associated parasympathetic symptoms and signs and the posterior hypothalamic region account for the cyclical pattern of the attacks, which tend to occur around the same time of the year for an individual patient [13]. While our knowledge surrounding calcitonin gene-related peptide's role in headache syndromes, specifically in cluster headache, is still evolving, CGRP levels have been shown to be elevated during cluster headache attacks and are reduced after administration of a triptan medication. CGRP is a potent vasodilator and leads to neurogenic inflammation as well as pain sensitization.

It is likely that CGRP plays an important role in the pathophysiology of cluster headache, and in fact the FDA recently approved a CGRP blocking monoclonal antibody for prevention of episodic cluster headache in adults [14].

Treatment of cluster headache involves optimizing lifestyle factors as reviewed above as well as in Sect. 4.4 coming up, but there are additional treatments that pertain to cluster headache specifically. For acute treatment of an attack, oxygen administration has been shown to be helpful in 56–82% of patients [15], and the recommendation is to administer 100% oxygen at a rate of between 6 and 12 liters per minute [16], while there is some suggestion that rates as high as 15 liters per minute may be used. Triptans have also been shown to be effective, particularly intranasal zolmitriptan and subcutaneous sumatriptan [16].

From a prophylactic standpoint, while many of the typical migraine preventative agents are used, verapamil in particular has Level C evidence categorizing it as possibly effective as per the American Headache Society (AHS) treatment guidelines for cluster headache [16]. Topiramate and lithium are also used, and melatonin may be helpful as an adjunct therapy [11]. More recently, occipital nerve blocks including a steroid ipsilateral to the head pain have been shown to be effective with Level A evidence from the same AHS guidelines [16]. A course of high-dose oral steroids may also be used as a transitional therapy while getting an oral daily preventive agent on board [11].

Paroxysmal Hemicrania

Similar to cluster headache, the onset of paroxysmal hemicranias is typically also in adulthood. Its prevalence is less than that of cluster headache. It has, however, been reported in children with similar symptoms as are seen in adults [17]. There is no male predominance [1].

As defined by the ICHD-3, paroxysmal hemicrania is diagnosed by meeting the following criteria [1]:

A. At least 20 attacks fulfilling criteria B–E
B. Severe unilateral orbital, supraorbital, and/or temporal pain lasting for 2–30 min
C. Either or both of the following:
1. At least one of the following symptoms or signs, ipsilateral to the headache:
• Conjunctival injection and/or lacrimation
• Nasal congestion and/or rhinorrhea
• Eyelid edema
• Forehead and facial sweating
• Miosis and/or ptosis
2. A sense of restlessness or agitation
D. Occurring with a frequency of >5 per day
E. Prevented absolutely by therapeutic doses of indomethacin
F. Not better accounted for by another ICHD-3 diagnosis

The differential for paroxysmal hemicrania is similar to that of cluster headache; therefore, it is recommended to obtain brain imaging with MRI brain and MRA of the head and neck [11].

What sets paroxysmal hemicrania apart from cluster headache are that the duration of each pain attack is shorter and it responds universally to indomethacin. Treatment should begin with an indomethacin trial, with a final total daily dose between 75 and 225 mg. A typical trial course is 2–4 weeks, and the patient should be placed on a gastritis preventative medication during this course [11].

Hemicrania Continua

Hemicrania continua shares the same associated features and response to indomethacin therapy as paroxysmal hemicrania but is diagnosed when the headache has been present without remission for >3 months. Patients with hemicrania continua may have migrainous features such as photophobia, phonophobia, and/or nausea but that are distinguished from migraine by its ipsilateral autonomic symptoms and response to indomethacin [1].

As defined by the ICHD-3, hemicrania continua is diagnosed by meeting the following criteria [1]:

A. Unilateral headache fulfilling criteria B–D
B. Present for >3 months, with exacerbations of moderate or greater intensity
C. Either or both of the following:
1. At least one of the following symptoms or signs, ipsilateral to the headache:
• Conjunctival injection and/or lacrimation
• Nasal congestion and/or rhinorrhea
• Eyelid edema

• Forehead and facial sweating
• Miosis and/or ptosis
2. A sense of restlessness or agitation, or aggravation of the pain by movement
D. Responds absolutely to therapeutic doses of indomethacin
E. Not better accounted for by another ICHD-3 diagnosis

The differential diagnosis of hemicrania continua is similar to that of cluster headache and also includes brain metastases and cerebral sinovenous thrombosis. As such, it is recommended to obtain an MRI brain with MRA head and neck, and MRV head should be considered [11].

Treatment should start with an indomethacin trial up-titrating as needed to a total maximum daily dose of 225 mg with subsequent dose weaning to the minimum effective dose. Once stable, a trial of weaning off indomethacin completely should be attempted. Other medications such as gabapentin, verapamil, topiramate, and melatonin may also be used [11].

Short-Lasting Unilateral Neuralgiform Headache Attacks

This subgroup of trigeminal autonomic cephalalgias includes short-lasting unilateral neuralgiform headache attacks with conjunctival injection and tearing (SUNCT) and short-lasting unilateral neuralgiform headache attacks with cranial autonomic symptoms (SUNA), and these are classified by how short in duration each pain episode is and the type of associated autonomic symptoms.

As defined by the ICHD-3, the overarching category of short-lasting unilateral neuralgiform headache attacks is diagnosed by meeting the following criteria [1]:

A. At least 20 attacks fulfilling criteria B–D
B. Moderate or severe unilateral head pain, with orbital, supraorbital, temporal, and/or other trigeminal distribution, lasting for 1–600 s and occurring as single stabs or a series of stabs or in a sawtooth pattern
C. At least one of the following five cranial autonomic symptoms or signs, ipsilateral to the pain:
1. Conjunctival injection and/or lacrimation
2. Nasal congestion and/or rhinorrhea
3. Eyelid edema
4. Forehead and facial sweating
5. Forehead and facial flushing
6. Sensation of fullness in the ear
7. Miosis and/or ptosis
D. Occurring with a frequency of at least once a day
E. Not better accounted for by another ICHD-3 diagnosis

SUNCT meets the above criteria and must include both conjunctival injection and lacrimation ipsilateral to the head pain, while SUNA meets the above criteria but with only one or neither of conjunctival injection and lacrimation. There may be some difficulty distinguishing short-lasting unilateral neuralgiform headache attacks from trigeminal neuralgia as autonomic symptoms may be seen with both. When autonomic symptoms are present in trigeminal neuralgia, however, they tend to be milder than those seen with SUNCT or SUNA [1].

The differential diagnosis of SUNCT and SUNA is similar to that of cluster headache, plus the addition of primary stabbing headache, trigeminal neuralgia, and a posterior fossa lesion. As such, it is recommended to obtain an MRI brain with MRA head and neck. Additionally, specific sequences looking at the trigeminal nerve may be considered [11].

The short-lasting unilateral neuralgiform headaches respond best to the prophylactic use of lamotrigine, though topiramate and gabapentin are also used in addition to other agents. Specific to this group of headaches is treatment with IV lidocaine, which may be helpful acutely and in some provides lasting benefit for months [11]. They do not tend to respond to indomethacin, which can be an important distinguishing factor from paroxysmal hemicrania or hemicrania continua.

Return to Clinical Cases

Case #1

A 13-year-old girl presents to her pediatrician for her yearly well-child check. Upon review of systems, she indicates that she has been having headaches for the last year at an average frequency of once per week. Upon further questioning, she describes the pain as a pressure-like sensation most prominent in the temple areas bilaterally, with extension in a band-like pattern around the entire head, a 3 out of 10 on a pain scale, typically lasting for 30–60 min. She denies associated nausea, vomiting, photophobia, or phonophobia. She has not missed any school or activities due to the headaches. The headaches typically occur on school days, and she notes that they greatly improved over the summer. On examination, she has normal vital signs including a normal-for-age blood pressure and normal body mass index. Her general health examination is normal, as are her neurologic and funduscopic examinations.

Headache type: Tension-type headache

Subtype: Based on the frequency of 4 headaches per month, she fits within the subcategory of frequent episodic tension-type headache.

Treatment: Reassurance is provided that she is having tension-type headaches. Lifestyle modifications are reviewed, and physical therapy is offered if needed. No daily prophylactic is suggested but she is told that she can use ibuprofen as needed to treat the acute headaches.

Case #2

A 17-year-old young man presents to his primary care physician for evaluation of headaches. He reports that he is having episodes of intermittent severe headaches lasting for 1 week at a time. He describes that during the week, he will have between 1 and 5 discrete headaches per day, each lasting for about 20 min with resolution in between. The head pain is described as 10 out of 10 (actually described higher but was told that 10 was the top pain that can be reported) on a pain scale, located around his right eye, with associated redness and tearing of that eye. He feels agitated during the episodes and is unable to participate in normal daily activities during the headache. He brings pictures of his face during an attack, and the pictures reveal right-eye injection with tearing, and the physician also notices ptosis of the right eyelid evident in the photographs. His last headache episode was 2 weeks ago. He recalls having had 7 such attacks occurring approximately every 4 months. On examination, he has normal vital signs including a normal blood pressure and body mass index. His general examination is normal, as are his neurologic and funduscopic examinations. Of note, there is no cranial nerve deficit seen on examination.

Headache type: Cluster headache

Subtype: Based on the frequency and periods of remission between attacks, he fits within the subcategory of episodic cluster headache.

Treatment: MRI brain and MRA of the head are obtained out of precaution and are normal prior to initiating treatment. For his treatment, while lifestyle modifications and complementary therapies are reviewed, he is in need of both preventative and rescue medications. Verapamil is initiated for prophylaxis. For rescue, a combination of high-flow oxygen via non-rebreather mask along with a triptan (intranasal zolmitriptan) is prescribed. Additionally, a course of prednisone is offered to help try to ease the cluster headaches for a bit while these treatments are started.

Case #3

A 16-year-old young man presents to his pediatrician for evaluation of headaches. He reports having two attacks per year of severe debilitating headaches. When these attacks occur, he will have severe left orbital pain lasting for 5 min, which recurs a total of 10 times per day with resolution in between episodes. He feels agitated when this occurs and describes the pain as a 10 out of 10 on a pain scale. He has associated swelling of the left forehead, and when he has looked in the mirror during an attack, his left pupil was smaller than the right. The episode will go on like this for an average of 2 weeks and then typically does not recur again until 6 months later. On examination, he has normal vital signs including a normal blood pressure and body mass index. His general examination is normal, as are his neurologic and funduscopic examinations.

Headache type: paroxysmal hemicrania

Subtype: episodic paroxysmal hemicrania

Treatment: MRI brain and MRA of the head and neck are obtained out of precaution and are normal prior to initiating treatment. Given that these occur only twice a year,

a daily preventative is discussed, but ultimately it is decided to focus on rescue for when these episodes occur. Indomethacin is offered to initiate at onset at 75 mg daily with option to titrate if needed. He is able to continue this for about 3 weeks to get him past his episodic paroxysmal hemicrania attack periods.

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