

# Diagnosing Secondary Headaches

The SNOOP10 mnemonic is a useful framework for diagnosing secondary headaches.

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Headache is a prevalent pain problem affecting 48.9% of the population globally,<sup>1</sup> and is a common chief complaint in inpatient, emergency department (ED), and outpatient

settings. Studies show that headache is among the 10 most common reasons for visits to primary care.<sup>2</sup> In the ED, headache is the fourth most common chief complaint, comprising approximately 3% of all ED visits in the US.<sup>3</sup>

## Headache Classification

The International Classification of Headache Disorders, 3rd edition (ICHD-3) divides headaches into 3 broad categories of primary headaches, secondary headaches, and neuropathies and facial pains.<sup>4</sup>

### Primary Headaches

Primary headaches include migraine, tension-type headache, cluster headache, trigeminal autonomic cephalalgias (TAC), and others. In primary headache, the headache itself is the disorder with no other underlying causes identified, and the diagnosis is based on clinical features.

### Secondary Headaches

Secondary headaches are those in which the headache is a symptom of another disorder recognized as a potential underlying cause.<sup>5</sup>

The ICHD-3 provides a list of 8 categories and 46 sub-categories for causes of secondary headaches including trauma or injury to the head and neck; cranial and cervical vascular disorders; nonvascular intracranial disorders; a substance or its withdrawal; infection; disorders of homeostasis; disorders of the cranium, neck, eyes, ears, nose, sinuses, teeth, mouth or other facial or cervical structure; and psychiatric disorders.<sup>4,6</sup>

Approximately 18% of people who experience a headache have a secondary headache disorder.<sup>5</sup> Although the majority

of headaches in clinical practice are primary headaches, clinicians need to be mindful of secondary headaches because the underlying conditions can be life-threatening or disabling and may require a completely different therapeutic approach than a primary headache disorder. Diagnosis of secondary headache disorders can be straightforward if a person with no prior headache history develops headache in the setting of a disorder known to cause headaches. In individuals who do have a prior history of headaches, however, the clinician must identify whether the current headache is their known primary headache disorder, an exacerbation of their primary headache disorder in the setting of another condition, or a new headache with a secondary cause. Many laboratory and neuroimaging studies can be ordered for a suspected secondary headache. However, simply running all tests on every person with a new or markedly different headache should be avoided because some tests have risks of adverse events, are costly, and may have incidental findings unrelated to headache or other pathology in approximately 8% of the population.<sup>6</sup> Therefore, detailed history taking, physical examination, and recognition of diagnostic red flags that may prompt appropriate secondary headache evaluation are crucial to diagnosis. In this article, we discuss headache red flags and provide tips for history taking and physical examination when evaluating people presenting with headaches.

## Comprehensive Headache History

The most critical aspect of headache diagnosis is history taking. Primary headache disorders are not diagnoses of exclusion but rather are based on supportive features of clinical history and physical examination. The presence of atypical features or red flags raises concern for secondary headaches (Table).

It is very important to begin with open-ended questions when obtaining a headache history, which should include frequency, duration, location, quality, severity, associated symptoms, and comorbidities, including head and neck symptoms and hormonal status.

**TABLE. THE SNOOP MNEMONIC FOR SECONDARY HEADACHE DISORDER RED FLAGS**

Mnemonic	History features	Physical examination features
<b>S</b> ystemic	History of malignancy, immunosuppression, or HIV or complaints of fever, chills, night sweats, myalgias, weight loss, or jaw claudication	Abnormal systemic examination, including blood pressure and temperature
<b>N</b> eurologic	Focal or global neurologic symptoms, including change in behavior or personality, diplopia, transient visual obscurations, pulsatile tinnitus, motor weakness, sensory loss, or ataxia	Abnormal neurologic examination
<b>O</b> nset, sudden	Headache reaches peak intensity in less than 1 minute (thunderclap)	
<b>O</b> nset age <5 or >65	New-onset headache before age 5 years New-onset headache after age 65	
<b>P</b> attern change	Progressive headache (evolution to daily headache) or change in headache characteristics	
	Precipitated by Valsalva maneuver	
	Postural aggravation	
<b>P</b> apilledema	n/a	Papilledema
<b>P</b> regnancy	New-onset headache during pregnancy Change in headache during pregnancy	
<b>P</b> henotype of rare headache	Trigeminal autonomic cephalalgia; hypnic; exercise-, cough-, or sex-induced	

**Frequency**

It is important to obtain an accurate headache frequency for headache classification. Often it is easier to ask patients “How many days in a month are you completely headache-free?” to get an accurate estimate of the headache days, instead of “How many days in a month do you have a headache?” Asking when people are headache-free tends to prompt them to include all headaches, whereas asking when they have headaches can lead to reporting of severe headaches to the exclusion of milder episodes.

**Duration**

Headaches can be divided into short duration (<4 hours) and long duration (≥4 hours). It is important to inquire about headache duration with and without treatment, because many individuals may report short headache duration because treatment shortened an episode that might have been longer. Additionally, if a person goes to sleep with a headache, the duration of sleep should be added to the headache duration if they wake without a headache.

**Location**

Many primary headache disorders are characterized by headache location. For example, migraines are often unilateral compared with tension-type headaches, which may be

bilateral. The TACs are defined by a side-locked trigeminal distribution. Brief, stabbing headaches in the distribution of a given nerve may suggest a neuralgia. When headaches do not change position and are very discrete in their localization, a careful head and neck exam should be completed.

**Quality, Severity, Associated Symptoms, and Comorbid Conditions**

Other parts of a comprehensive headache history include headache quality, severity, and associated symptoms (eg, photophobia, phonophobia, nausea, and vomiting). Symptoms relating to structures in the head (eg, the temporomandibular joint [TMJ], teeth, or ear) and neck should be reviewed. Hormonal status is important for both diagnosis (eg, excluding menstrual-related headaches, migraine or side effects of hormone supplementation) and planning treatment (eg, pregnancy and lactation planning, or contraception). Common comorbidities of headache, including sleep disorders, psychiatric conditions (eg, anxiety or depression), and vascular conditions should be reviewed to help guide diagnostic and management plans.

**Neurologic and Physical Examination**

Vital signs provide crucial hints to overall health and may guide diagnostic and treatment decisions. Heart rate and

blood pressure should be reviewed before prescribing beta-blockers or other blood pressure medications as headache preventatives. A person's body mass index (BMI) should be considered when prescribing medications that could cause weight gain or weight loss. A general psychiatric assessment that includes mood and affect is important to identify potential psychiatric comorbidities of headache.

Head and neck examination is necessary. Palpate and check for allodynia, supraorbital or auriculotemporal, and occipital notch tenderness. Feel the TMJ, jaw movement, and the pulsation of temporal arteries. Examine pericranial and paraspinal muscles, paranasal sinuses, and neck range of motion. Check posterior pharyngeal structures to assess sleep apnea risk.

A comprehensive neurologic examination in headache, just as for any other chief complaint, should include mental status, cranial nerves (including pupils, funduscopic exam, visual fields, ocular motility, facial strength and sensation, and palate/tongue exam), a comprehensive motor and sensory exam, reflexes and plantar responses, coordination, and gait. Assessing joint hypermobility and documenting the Beighton score<sup>7</sup> is also helpful if there is suspicion for a cerebrospinal fluid (CSF) leak.

### Secondary Headache Red Flags—the SNNOOP10 Mnemonic

It is essential to take the time to perform a structured history as a standard practice for every person with new or different headache to ensure not overlooking secondary headache red flags. Keep in mind that history should be taken and not accepted, because people may not volunteer important information that could suggest secondary headache disorders. Inform people why certain questions are asked and physical examination maneuvers performed; this not only reassures a person that they are being evaluated for secondary causes of their headache but also creates the opportunity to educate people about what they should be monitoring with regards to their headaches. For headache red flags, the SNOOP4 mnemonic or the expanded SNNOOP10 are helpful guides (Table) covered in the next sections of this review.<sup>6-8</sup>

#### S: Systemic Signs and Symptoms

The headache history should include a review of past medical and surgical history as well as a review of systems. Ask about systemic symptoms such as fevers, chills, sweats, myalgia, and weight loss, which could suggest potential infection, malignancy, rheumatic disease, vasculitis (including giant cell arteritis), or other inflammatory diseases. Concurrent fever and headache have a relatively high sensitivity for neurologic infections, including bacterial meningitis, viral meningitis, encephalitis, and brain abscesses.<sup>8</sup>

Patients who are immunocompromised by chronic infection, malignancy, immunosuppressive therapy, or other causes may have atypical manifestations for causes of secondary headache because of their suppressed inflammatory response (eg, no fever with infection). Special care must be taken to consider opportunistic infections, secondary malignancies, side effects of any medications, and rarer conditions (eg, immune reconstitution inflammatory syndrome). It is also very important to know whether there is a history of malignancy, which raises the concern for metastatic disease of the central nervous system. Although the risk of finding a brain tumor in a person with headache who has no history of malignancy is quite low (<0.1%),<sup>8</sup> a newly developed headache in a person with a neoplasm is highly concerning for an intracranial metastasis.

#### N: Neurologic Symptoms or Signs

There are numerous studies detailing the probability of secondary headache disorders in people with neurologic signs and symptoms. Adults presenting in the ED have positive likelihood ratios for secondary headache disorders of 3.56 to 16.2 if there are findings on their neurologic examination.<sup>9,10</sup> Among children with headache presenting to the ED, all who received a diagnosis of a serious underlying pathologic process for their headaches had objective neurologic signs.<sup>11,12</sup> It is important to inquire about neurologic symptoms or signs, including motor, sensory, speech, vision, balance, and cognitive symptoms, and whether these are constant or transiently related to the headaches. Ask about any changes in behavior or personality including visual, auditory, or olfactory hallucinations, because these could be suggestive of a localized lesion or seizures. Additionally, ask specifically about diplopia, transient obscured vision, and pulsatile tinnitus, because those could be suggestive of idiopathic intracranial hypertension.

#### O: Onset, Sudden

*Thunderclap headache* is defined as a headache with an abrupt onset that reaches maximum intensity in less than 1 minute and lasts for 5 or more minutes.<sup>4</sup> When evaluating whether a headache may have had thunderclap onset, rather than asking if the headache came on quickly or suddenly, it is important to quantify the exact speed of onset. Ask, "How quickly did your pain go from 0 out of 10 to 10 out of 10—seconds, minutes or hours?" The most common causes of thunderclap headaches are subarachnoid hemorrhage and reversible cerebral vasoconstriction syndromes (RCVS). Other vascular and nonvascular causes include stroke, cerebral venous sinus thrombosis, arterial dissection, intracerebral hemorrhage, acute hypertensive crisis, posterior reversible leukoencephalopathy syndrome, spontaneous intracranial hypotension (SIH), idiopathic

intracranial hypertension, cerebral infection (eg, meningitis, acute complicated sinusitis), and pituitary apoplexy.<sup>13</sup>

#### **O: Onset, Age of**

Onset of headache before age 5 years or after age 65 years is among the most predictive red flags for secondary headache disorders.

In children, the most common secondary causes of headaches are often nonsinister, such as upper respiratory tract infection and posttraumatic headache.<sup>14</sup> Sinister causes of pediatric headache, such as brain tumors, are higher in preschool-age children. It is important to note that studies show preschoolers with dangerous headaches often have other red flags, including abnormal physical examinations, worsening headache during the night, and headache provoked by coughing, sneezing, or crying.<sup>15</sup>

It is unusual for primary headache disorders to begin after age 65 and very important to clarify whether a headache is truly new onset or if there was a history of prior headaches or conditions such as episodes of migraine-related symptoms that a person may not have perceived as related to headaches. A prospective study reported the frequency of secondary headache was higher in people age 65 or more (11.2%) compared with those under age 65 (8.0%). In both groups, the most common secondary headache diagnosis was headache attributed to infection. Other secondary causes in people age 65 or more included trauma or head and neck injury, cranial or cervical vascular disorders, nonvascular intracranial disorders, use or withdrawal of a substance, homeostasis, and cranial disorders affecting the neck, eyes, ears, nose, sinuses, teeth, mouth or other facial or cervical structure.<sup>16</sup> When evaluating headache in someone age 65 or more, it is important to consider secondary causes such as neoplasms, inflammation, infection, giant cell arteritis, and other neurologic diseases.

#### **P: Pattern Change**

A change in headache pattern or characteristics for people who have a prior history of headache can indicate a secondary etiology. This includes new symptoms associated with the headache such as a newly developed aura, loss of headache-free periods, or change in frequency (eg chronic daily headache in someone who has previously had episodic migraine). Careful evaluation is indicated to assess for secondary causes, and diagnosis may be delayed under those circumstances.

#### **P: Precipitated by Valsalva Maneuver, Sneezing, Coughing, or Exercise**

Consider neuroimaging when headaches are provoked by coughing, straining, or other Valsalva maneuvers. Secondary cough headache accounts for 40% of all cough headache cases, and therefore a diagnosis of primary cough headache can only be given after secondary causes have been ruled

out. The most common cause of cough headache is Chiari malformation type 1.<sup>4</sup> Posterior fossa lesions account for approximately 15% of cases of cough headache.<sup>8</sup> Other causes of cough headache include meningiomas, brain metastases, arachnoid cysts, subdural hematoma, intracranial hypertension or hypotension, infection, hydrocephalus, and vascular diseases such as RCVS.<sup>4, 8, 17, 18</sup>

#### **P: Postural Aggravation**

Headaches precipitated and aggravated by postural change raise concern for abnormal intracranial pressure, either too high or too low.

Headaches that are worse when supine raise concern for increased pressure, which can be evaluated with neuroimaging to look for structural causes. If imaging does not show any unstable lesions, then lumbar puncture can be pursued for diagnostic and therapeutic purposes.

Headache that occurs within seconds of being upright and resolves quickly after lying horizontally suggests low CSF pressure. For individuals who recently underwent procedures including lumbar puncture, neurosurgery, or any kind of epidural injection, the positional feature can be very prominent and easily recognizable. The incidence of spontaneous intracranial hypotension (SIH) is estimated to be 5 per 100,000, and postural features may be more subtle or have resolved over time. Instead of reporting a prominent positional feature, individuals with SIH might report that the headache is usually worse the second half of the day or after they have been upright for a while or that they usually feel the best in the morning before they get out of bed.<sup>11, 12</sup> Evaluation and management of low CSF pressure can be very complicated, especially if classic radiologic findings are not present.

Cervicogenic headache can also be aggravated by the position because of axial loading of the spine, or head turning to a particular position. Orthostatic hypotension and postural orthostatic tachycardia syndrome (POTS) can also cause postural headaches, which are usually accompanied by other symptoms of orthostatic intolerance including dizziness and presyncope.<sup>11</sup>

#### **P: Papilledema**

Papilledema should always lead to further investigation. Although there can be mimics of optic disc edema such as pseudopapilledema, papilledema is a predictor for intracranial abnormalities and intracranial hypertension.<sup>12</sup> In addition to a thorough funduscopic exam, it is very important to ask about transient obscured vision, diplopia, and field defects that could indicate intracranial hypertension.

#### **P: Pregnancy, Painful Eye, Posttrauma, Pathology, Phenotype, and Painkiller Overuse**

Other factors proposed in the longer SNNOOP10 include

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pregnancy, painful eye with autonomic features, posttraumatic headache, pathology (immune or oncologic), and painkiller overuse (medication overuse headache [MOH]) or use of a new drug at onset.

## Conclusion

The most crucial aspect of headache diagnosis is the history and physical exam. Primary headache disorders are not diagnoses of exclusion but rather are based on supportive clinical features. The presence of atypical features or red flags should raise concern for secondary headaches. The SNOOP mnemonic is a helpful approach to ensure that red flags are not overlooked. ■

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