"Sinus headache": rhinogenic headache or migraine? An evidence-based guide to diagnosis and treatment

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Background: **Patients present to physicians across multiple disciplines with the complaint of sinus headache. This lay term is widely accepted in the media, yet has been repeatedly questioned in the medical literature, and experts in the fields of otolaryngology, neurology, and allergy have agreed that it is an overused and often incorrect diagnosis in the majority of patients. There have been review articles and consensus panels established regarding this issue, but thus far no guidelines based purely on a review of the level of evidence provided by the literature.**

Methods: **A systematic review of the literature was performed and the Clinical Practice Guideline Manual, Conference on Guideline Standardization (COGS), and the Appraisal of Guidelines and Research Evaluation (AGREE) instrument recommendations were followed. Study inclusion criteria were: adult population >18 years old, self-diagnosed or physician-diagnosed "sinus headache," clearly defined diagnostic criteria in diagnostic studies, and clearly defined primary clinical end-point in therapeutic studies.**

Results: **We identified and evaluated the literature on diagnosing and treating patients with a primary complaint of sinus headache. The literature was reviewed for both quality of research design as well as benefit and harm of the proposed interventions.**

Conclusion: **If a thorough neurologic and otolaryngologic evaluation is performed, the majority of patients presenting with sinus headache in the absence of significant acute inflammatory findings will be diagnosed with migraine. In this situation, the appropriate treatment for the majority of patients presenting with sinus headache is migraine directed therapy. In a highly select group of patients, directed nasal surgery addressing endonasal contact points may be an option.** © 2013 ARS-AAOA, LLC.

Key Words:
headache; sinus headache; rhinogenic headache; migraine; contact points

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Headache is an almost universal affliction, affecting almost everybody at least once in a lifetime, and has been a diagnostic and therapeutic challenge for physicians since the beginnings of medical practice. In ancient Egypt, headache sufferers were told that anointing the head with the ground skull of a catfish would relieve the pain.[1] In the 1890s, Isaac Emerson advertised Bromo-Seltzer as a cure-all for headache and became as wealthy and famous in his day as Bill Gates is in modern times.[2]

"Sinus headache," although a commonly used term in both patient self-diagnosis and primary care physician diagnosis, as well as in the general media and advertising community, has been held by specialists in the fields of otolaryngology, allergy, and neurology as an imprecise term that is often responsible for improper treatment.[3] This term is usually used when the headache patient also suffers facial pain or pressure, a symptom traditionally associated with sinus disease. A more accurate terminology would be rhinogenic headache, if a physician truly thinks the symptoms are from the nasal region, but "sinus headache" appears to be the choice of patients and primary care doctors alike, and is

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TABLE 1. RTF definition of major and minor factors in the diagnosis of sinusitis in adults*

Major factors
Facial pain/pressure must be associated with another major factor
Facial congestion/fullness
Nasal obstruction/blockage
Nasal discharge/drainage
Hyposmia/anosmia
Fever (in acute)
Minor factors
Headache
Fever must be associated with another major nasal symptom
Halitosis
Fatigue
Dental pain
Cough
Ear pain/pressure/fullness

*Adapted from Lanza DC, Kennedy DW. Adult rhinosinusitis defined. *Otolaryngol Head Neck Surg.* 1997;117:S1-S7.
RTF = Rhinosinusitis Task Force.

thus the term rhinologists and neurologists have used when enrolling patients in studies to look at this issue.

Over the past decade we have learned more about how and why facial pain and pressure, even when associated with symptoms like nasal congestion and rhinorrhea, may actually be more commonly associated with migraine.[4] It thus becomes important to discuss the diagnostic criteria outlined by 2 major societies for the diagnosis of both sinusitis and migraine.

The American Academy of Otolaryngology–Head and Neck Surgery (AAO-HNS) established a Rhinosinusitis Task Force (RTF) to establish diagnostic criteria for acute and chronic sinusitis. First established in 1997, and then further elaborated in 2003, these criteria are set forth in Tables 1, 2, and 3.[5,6] Interestingly, facial pressure or pain is not enough to diagnose chronic sinusitis when it stands alone, only when combined with another major factor.

The International Headache Society (IHS) has also established diagnostic criteria for "headache attributed to rhinosinusitis" as well as for migraine with and without aura, and these criteria are set forth in Tables 4 and 5.[7] It is essential to recognize their insistence on acuity of the sinus problem in relation to headache. The IHS has stated that chronic sinusitis is "not validated as a cause of headache or facial pain unless relapsing into an acute stage." Also worth remarking upon is the fact that mucosal contact point headache has a place within the Appendix A11.5.1, simply stated as a cause of headache for which evidence is limited. We survey that evidence as well later in this review.

TABLE 2. RTF definitions of acute and chronic sinusitis*

Acute sinusitis
Duration 4 or less weeks
2 or more major factors OR
1 major + 2 minor factors OR
Nasal purulence on exam
Chronic sinusitis
Duration 12 or more weeks
2 or more major factors OR
1 major + 2 minor factors OR
Nasal purulence on exam

*Adapted from Lanza DC, Kennedy DW. Adult rhinosinusitis defined. *Otolaryngol Head Neck Surg.* 1997;117:S1-S7.
RTF = Rhinosinusitis Task Force.

TABLE 3. 2003 RTF revised criteria to also include 1 of the following for the diagnosis of chronic sinusitis*

Discolored nasal drainage from the nasal passages, nasal polyps, or polypoid swelling as identified on physical examination with anterior rhinoscopy after decongestion or nasal endoscopy
Edema or erythema of the middle meatus or ethmoid bulla on nasal endoscopy
Generalized or localized erythema, edema, or granulation tissue (if the middle meatus or ethmoid bulla is not involved, radiologic imaging is required to confirm a diagnosis)
CT scanning demonstrating isolated or diffuse mucosal thickening, bone changes, or air-fluid levels OR
Plain sinus radiography revealing air-fluid levels or greater than 5 mm of opacification of 1 or more sinuses

*Adapted from Kari E, DelGaudio JM. Treatment of sinus headache as migraine: the diagnostic utility of triptans. *Laryngoscope.* 2008;118:2235–2239.
CT = computed tomography; RTF = Rhinosinusitis Task Force.

It is important to note, especially in this evidence-based guide, that the criteria put forth by the AAO-HNS and the IHS are not culled from evidence-based review of the literature, but instead characterize the expert opinion in their respective fields. However, they give us the ability to evaluate the significance of the diagnostic endpoints used in the studies we will review, and that is why they are included here.

Again, the purpose of this report is to review the published literature evaluating the cause and potential treatments of "sinus headache." This review is not intended to replace professional judgment. Clinical judgment remains critical to determining the most appropriate care for each individual patient.

TABLE 4. IHS diagnostic criteria for headache attributed to rhinosinusitis*

1. Frontal headache accompanied by pain in 1 or more regions of the face, ears, or teeth, and fulfilling criteria 3 and 4
2. Clinical, nasal endoscopic, CT and/or MRI, and/or laboratory evidence of acute or acute-on-chronic rhinosinusitis[a]
3. Headache and facial pain develop simultaneously with onset or acute exacerbation of rhinosinusitis
4. Headache and/or facial pain resolve within 7 days after remission or successful treatment of acute or acute-on-chronic rhinosinusitis

*Adapted from Levine et al. An otolaryngology, neurology, allergy, and primary care consensus on diagnosis and treatment of sinus headache. *Otolaryngol Head Neck Surg*. 2006;134:516–523.

[a]Clinical evidence may include purulence in the nasal cavity, nasal obstruction, hyposmia, anosmia. and/or fever.
CT = computed tomography; IHS = International Headache Society; MRI = magnetic resonance imaging.

TABLE 5. IHS diagnostic criteria for migraines

Migraine with aura
1. At least 2 attacks fulfilling criteria 2–4 if aura is present
2. Headache lasts 4–72 hours
3. Headache that has 2 of the following: unilateral, pulsating quality, moderate or severe pain intensity, aggravated by or causing avoidance of routine physical activity
4. One of the following occurs during the headache: nausea, vomiting, photophobia, phonophobia
5. Headache cannot be attributed to another disorder
Migraine without aura
1. At least 5 attacks fulfilling criteria 2–4 when aura is not present
2. Headache lasts 4–72 hours
3. Headache that has 2 of the following: unilateral, pulsating quality, moderate or severe pain intensity, aggravated by or causing avoidance of routine physical activity
4. One of the following occurs during the headache: nausea, vomiting, photophobia, phonophobia
5. Headache cannot be attributed to another disorder

Adapted from Kari E, DelGaudio JM. Treatment of sinus headache as migraine: the diagnostic utility of triptans. *Laryngoscope*. 2008;118:2235–2239.
IHS = International Headache Society.

Materials and methods

The Clinical Practice Guideline Manual,[8] Conference on Guideline Standardization,[9] Appraisal of Guidelines and Research Evaluation,[10] and the International Forum of Allergy and Rhinology recommendation for Evidence-Based Review Using an Online Iterative Process[11] were all followed to assure the quality and transparency of our review process.

A systematic review of the English literature was performed using Medline, EMBASE, and Cochrane Review Databases up to January 2012. Keywords used for this search included "sinus," "rhinogenic," "headache," "migraine," "rhinosinusitis," and "contact points" in multiple combinations. The resulting 1450 abstracts were then searched for relevancy to our topic at hand, pertinent abstracts were reviewed, and the following inclusion criteria were applied: adult population >18 years old, self-diagnosed or physician-diagnosed "sinus headache," clearly defined diagnostic criteria in diagnostic studies, and clearly defined primary clinical end-point in therapeutic studies.

Although multiple case reports surfaced linking headache in the facial or sinonasal region with any number of organic causes such as tumors, prior trauma, iatrogenic sources, and other inflammatory conditions such as temporomandibular joint disorders, these accounted for less than 5% of the literature surrounding "sinus headache," and none of these sources are at the center of any controversy or confusion in diagnosis or treatment. In the same vein, there are multiple possible headache disorders that can masquerade as sinusitis, including cluster headache, paroxysmal hemicrania, hemicrania continua, tension headache, and analgesia dependent headache, along with the most commonly correct diagnosis of migraine, but an in-depth look at each of the above diagnoses is beyond the scope of this paper. We have chosen, therefore, to not include these in our current review, with the caveat that when seeing a patient in clinical practice, all of the above must remain in the possible list of differential diagnoses entertained by the treating physician, and each individual patient must be diagnosed and treated using sound clinical judgment in addition to evidence-based literature.

Included studies were evaluated for level of evidence based on the Oxford Centre for Evidence-Based Medicine (CEBM) method.[12] After evaluating each study, a summary was produced including the aggregate grade of evidence and recommendations based on the American Academy of Pediatrics guidelines (Table 6).[13] Two authors (Z.M.P., J.M.D.) reviewed the literature and produced the initial manuscript. One at a time, subsequent authors (D.W.K., M.S., D.M.P.) were asked to review and critically appraise the recommendations based on the literature. Areas of controversy were debated in an electronic format until consensus was achieved. When evidence was sufficient, taking into account both quality of research as well as benefit vs harm analysis, a recommendation was provided.

Results

Establishing diagnosis in the patient with "sinus headache"

Most of the literature discussing sinus headache is centered around diagnosis. As "sinus headache" is not actually a medical term, the majority of the dialogue revolves around distinguishing between neurologic origin of headache and sinonasal origin of headache. Although several expert opinion papers based on clinical experience and physiologic

TABLE 6. Recommendations based on defined grades of evidence*

Grade	Research quality	Preponderance of benefits over harm	Balance of benefit and harm
A	Well designed RCTs	Strong recommendation	Option
B	RCTs with minor limitations; overwhelming consistent evidence from observational studies	Strong recommendation/ recommendation	Option
C	Observational studies (case-control and cohort design)	Recommendation	Option
D	Expert opinion; case reports; reasoning from first principles	Option	No recommendation

*Adapted from Rudmik L, Smith TL. Development of an evidence-based review with recommendations using an online iterative process. *Int Forum Allergy Rhinol.* 2011;1:431–437.

RCT = randomized controlled trial.

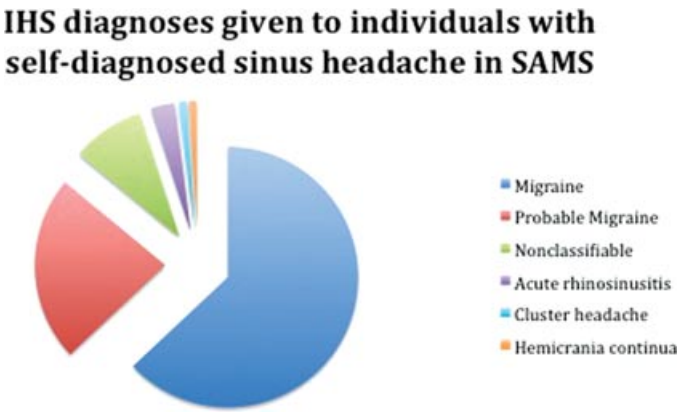

FIGURE 1. IHS diagnoses given to individuals with self-diagnosed sinus headache in SAMS. IHS = International Headache Society; SAMS = Sinus Allergy and Migraine Headache Study.

research came out in the late 1980s and early 1990s,[14–16] raising awareness about the complexity of headache and the possible interplay between the sinonasal region and neurologic symptoms, it was not until this prior decade that true clinical research was embarked upon to answer these questions. Although there were no randomized controlled trials (RCTs) looking at diagnosis in sinus headache, this review identified a total of 6 prospective cohort studies establishing diagnosis or differential diagnosis in patients with sinus headache.

In 2002, Barbanti et al.[4] studied 177 consecutive migraineurs and discovered that 45.8% of these patients exhibited unilateral cranial autonomic symptoms such as lacrimation, conjunctival injection, eyelid edema, rhinorrhea, and nasal congestion in association with their headaches. Interestingly, patients with these symptoms had headaches that were more severe ($p < 0.0002$) and more strictly unilateral ($p < 0.0004$) than those without.

Perry et al.[17] looked at 100 consecutive patients in a tertiary rhinology practice with self diagnosed "sinus headache" but no evidence of sinus disease or mucosal contact points on nasal endoscopy or computed tomography (CT) scan, and found that 36 patients listed headache as their chief complaint. Of these 36 patients, 58% were diagnosed with migraine after referral to a neurologist.

Similarly, a 1-year cross-sectional prospective study by Foroughipour et al.,[18] published in 2011, evaluated 58 patients with the diagnosis of sinus headache made by a primary care physician. Exclusion criteria included prior diagnosis of migraine, tension headache, mucopurulent secretions, and evidence of sinus infection during the past 6 months. After assessing those patients monthly with "comprehensive otorhinolaryngologic and neurologic evaluation" for 6 months, final diagnoses were migraine, tension-type headache, and chronic sinusitis with recurrent acute episodes in 68%, 27%, and 5% of the patients, respectively.

In 2004, Schreiber at al.[19] included 2991 patients in a prospective observational study, using 452 different sites, with self-described or physician-diagnosed sinus headache. IHS diagnostic criteria were used to give a diagnosis to each patient. Exclusion criteria included prior diagnosis of migraine, prior use of a triptan, an abnormal sinus X-ray in the preceding 6 months, and fever or purulent discharge. Migraine with or without aura was the IHS diagnosis given to 80% of patients, with an additional 8% earning the diagnosis of migrainous headache (equivalent to probable migraine under the 2004 IHS criteria). Symptoms traditionally associated with sinus disease were extremely prevalent in this population, with 84% complaining of sinus pressure, 82% of sinus pain, and 63% of nasal congestion.

The Sinus Allergy and Migraine Headache Study (SAMS) recruited 100 consecutive adults in the greater Phoenix, AZ, metropolitan area, with no exclusion criteria, who believed they suffered from sinus headache.[20] Using IHS criteria, 63% of these patients were diagnosed with migraine, 23% with probable migraine, 3% with headache secondary to rhinosinusitis, 1% with hemicrania continua, 1% with cluster headache, and 9% that could not be classified (Fig. 1). Most common associated features were nasal congestion (56%), eyelid edema (37%), rhinorrhea (25%), conjunctival injection (22%), lacrimation (19%), and ptosis (3%). They cited migraine triggers to be weather changes (83%), seasonal variation (73%), exposure to allergens (62%), and changes in altitude (38%). Sixty-two percent (62%) experienced bilateral forehead and maxillary pain with their headaches, and 76% reported pain in the distribution of the second division of the trigeminal nerve. The authors

concluded that the most common reasons for misdiagnosis included specific triggers, location of pain over the sinonasal region, and associated features ("guilt by provocation, location, and association").

Taking a slightly different approach, Mehle and Kremer[21] also looked at 35 patients presenting with self-diagnosed sinus headache, first assessing with IHS criteria for migraine and then sending all patients for a sinus CT scan. In line with prior studies, they found that 74% of patients presented with IHS criteria for migraine. Of note, however, 5 of the 26 patients with migraine were found to have substantial sinus disease on CT, with Lund-McKay scores of 5 or above. The authors concluded that a positive migraine history apparently does not exclude the need for a complete ear, nose, and throat (ENT) workup, including CT scanning.

In spite of not having any RCTs to evaluate about the proper diagnosis of sinus headache, there is an overwhelming preponderance of evidence substantiated by the prospective clinical studies described above that the patient presenting with sinus headache should be thoroughly assessed for both possible rhinologic diagnoses with nasal endoscopy and CT scan, as well as neurologic diagnoses using history and IHS criteria, and that the majority of these patients will be found to have migraine.

Summary: Diagnosis of migraine in the patient with "sinus headache" (Table 7)

1. Aggregate quality of evidence: B (Level 2b: 5 studies, Level 1b: 1 study).
2. Benefit: Comprehensive workup and prompt diagnosis of migraine will allow patients to undergo the appropriate treatment instead of undergoing either medical or surgical therapy directed at sinonasal disease.
3. Harm: Although there appears to be possible comorbidity between sinus disease and migraine, a complete workup will prevent missed diagnoses and inadequate treatment; thus, there does not appear to be any harm in this methodology.
4. Cost: Minimal to moderate; including endoscopy and CT scan in initial assessment increases overall cost of healthcare.
5. Benefits-Harm assessment: Preponderance of benefit over harm.
6. Value Judgments: Lack of any exclusion criteria in our Level 1b study both strengthens its conclusion in a certain respect as well as makes it more difficult to formulate our recommendation. All other prospective studies used abnormal CT and endoscopy as exclusion criteria.
7. Policy level: Recommendation for comprehensive evaluation of the patient presenting with sinus headache to include thorough head and neck examination, including neurologic exam, nasal endoscopy, CT scan, application of IHS criteria, and high clinical suspicion for migraine diagnosis, as this has been shown to be the most likely diagnosis in this subset of patients. In a minority of cases where nasal endoscopy and CT scan do show signs of significant sinus disease, the patient should obviously be diagnosed appropriately with acute or chronic sinusitis, and treated for that disease.

TABLE 7. Summary of the diagnosis of sinus headache studies

Study	Year	Study design	Level of evidence	Number of subjects	Diagnostic criteria	Conclusions
Barbanti et al.[4]	2002	Prospective cohort	2b	177	IHS criteria	Almost one-half of migraine patients exhibit unilateral cranial autonomic symptoms.
Perry et al.[17]	2004	Prospective cohort	2b	36	IHS criteria	Majority of patients with primary headache complaint in a tertiary rhinology practice have migraine.
Schreiber et al.[19]	2004	Prospective cohort	2b	2991	IHS criteria	Migraine with or without aura is diagnosis of "sinus headache" patient the majority of the time.
Eross et al.[20]	2007	Prospective cohort	1b	100	IHS criteria	Majority of patients with "sinus headache" diagnosed with migraine. Most common reason for prior misdiagnosis were triggers, provocation, and location.
Mehle and Kremer[21]	2008	Prospective cohort	2b	35	IHS criteria	Majority of patients with "sinus headache" diagnosed with migraine. Positive migraine history does not obviate need for thorough ENT workup as some of these patients will have positive sinus CT scans.
Foroughipour et al.[18]	2011	Prospective cohort	2b	58	IHS criteria	Majority of patients with "sinus headache have migraine.

CT = computed tomography; ENT = ear, nose, and throat; IHS = International Headache Society.

Establishing treatment in the patient with "sinus headache"

Treatment of headache as migraine

This review identified 3 level 2b studies and 1 level 1b study examining treating the patient with sinus headache with migraine therapy.

In 2002, Cady et al.[22] recruited 47 consecutive patients suffering from "sinus headache," with exclusion criteria including prior diagnosis of migraine, prior use of triptans, presence of fever or purulent drainage, or evidence of sinus infection on imaging over the last year. Patients were asked to treat their headaches with sumatriptan (a migraine-specific therapy) and the percentage of headaches that were reduced to mild or no pain was 66%.

In 2008, Kari and DelGaudio[23] published a prospective study also looking at triptan use in patients with sinus headache. A total of 54 patients were enrolled who had a complaint of facial pain, pressure, or headache localized over the area of the sinuses, and a self- or physician-diagnosis of sinus headache. Exclusion criteria included contraindications to triptan use or other identifiable causes of headache. Patients underwent comprehensive otolaryngologic evaluation including nasal endoscopy and CT scan to assure no signs of sinusitis. Thirty-one patients (82%) had significant reduction in headache pain with triptan use. Of importance, 18 patients (34%) withdrew or failed to follow-up, "often reluctant to accept a diagnosis of migraine" in spite of a normal CT and a normal nasal endoscopy.

A similar study, but with a different migraine treatment protocol, was published in 2010 by Dadgarnia et al.[24] prospectively evaluating 104 patients with self or physician-diagnosed sinus headache. A complete head and neck examination was performed, including nasal endoscopy and CT scan, with exclusion criteria of acute rhinosinusitis, sinonasal polyposis, a prior history of sinonasal surgical operation, or contraindication of sodium valproate use. Patients with normal endoscopy and CT scan were given sodium valproate to take on a daily basis as migraine prophylaxis; 61% showed significant improvement in headaches.

The best and most convincing study which looked at treating "sinus headache" as migraine, was published in 2007 by Ishkanian et al.[25] This was a randomized, double-blind, placebo-controlled study looking at the efficacy and tolerability of sumatriptan in patients presenting with "sinus headache" who fit the IHS criteria for migraine. Exclusion criteria included fever, purulent nasal drainage, sinus disease on imaging in the past 3 months, prior diagnosis of migraine, prior use of migraine medication, or contraindication to triptan use. Carried out across 26 centers in the United States, they demonstrated a statistically significant difference when 69% and 76% of patients treated with a single 50-mg dose of sumatriptan achieved a positive headache response at 2 and 4 hours, compared with a placebo response of 43% and 49%, respectively.

Based on the evidence, it appears that after ruling out sinus pathology with nasal endoscopy and CT scan, the majority of patients with self- or physician-diagnosed sinus headache respond well to migraine therapy, commonly a triptan.

Summary: Migraine-directed therapy in the patient with "sinus headache" (Table 8)

1. Aggregate quality of evidence: Level B (level 2b: 3 studies, level 1b: 1 study).

TABLE 8. Summary of treatment of sinus headache as migraine studies

Study	Year	Study design	Level of evidence	Number of subjects	Study groups	Protocol	Primary endpoint	Conclusion
Cady et al.[22]	2002	Prospective cohort	2b	47	Sumatriptan	2 doses 50 mg	Reduction of moderate to severe headaches to mild or no pain	Majority of patients with "sinus headache" are effectively treated with migraine-directed therapy
Kari and DelGaudio[23]	2008	Prospective cohort	2b	54	Eletriptan or other migraine-directed therapy	40 mg for every headache over 1–3 months	50% reduction in frequency and severity of headaches	Large majority of patients with "sinus headache" are effectively treated with migraine-directed therapy, and this treatment may aid in diagnosis
Dadgarnia et al.[24]	2010	Prospective cohort	2b	104	Sodium valproate	Daily over 6 months	Improvement based on pain visual analog scale	Migraine-directed therapy is effective in majority of "sinus headache" patients
Ishkanian et al.[25]	2007	RCT	1b	216	Sumatriptan	1 dose 50 mg	Reduction to no or mild pain on 4-point pain scale	Sumatriptan is effective in treating patients with "sinus headache"

RCT = randomized controlled trial.

2. Benefit: Migraine therapies, such as triptans, are generally well tolerated and show efficacy in treating this patient population.
3. Harm: As with all medications, migraine-directed medications carry side effects. Triptans should only be used in patients who do not have cardiovascular issues, or other contraindications.
4. Cost: Triptans are not yet available in the United States in generic form, so they can be costly to either the patient or the insurance company providing coverage. However, this cost is mitigated by decreasing the cost spent on unnecessary surgery and medication directed at nonexistent sinus disease.
5. Benefits-Harm assessment: Preponderance of benefit over harm.
6. Value Judgments: None.
7. Policy level: A migraine-directed therapy, such as a triptan, should be the next step when a patient presenting with sinus headache has been shown to have no sinus pathology on nasal endoscopy or CT scan. This should be followed by referral to Neurology.

Treatment of mucosal contact points

As illustrated above, the general conclusions of the literature point to treating sinus headache as migraine when there is a normal sinonasal endoscopy and scan. However, many of the studies examined did not specify whether an "abnormality" was solely based on sinus disease or if this included mucosal contact points. Because the topic of contact point induced headache has been discussed so much in the literature, is greatly debated, and remains controversial within the fields of both otolaryngology and neurology, we felt the need to include an analysis of the evidence surrounding this issue within this review.

A contact point is defined as a place within the nasal cavity where 2 apposing mucosal surfaces come to a point where they touch each other. This could be due to a septal spur, a medialized middle or superior turbinate, etc.

There are no studies above Level 4 evidence on this topic in the literature, with multiple retrospective studies and expert opinion pieces found. RCTs are absent, and the prospective studies found either lack objective comparison groups, have insufficient numbers for statistical significance, or have insufficient follow-up time. These shortcomings in evidence should weigh heavily in the mind of any surgeon contemplating this diagnosis and possible treatments for it. However, in spite of having a low level of evidence, these prospective studies all appear to point in the same direction.

As far back as 1948, the idea surfaced that pain could be referred between the meninges and the sinonasal cavity. Wolff[26] established, through a series of experiments, that traction on different regions of the meninges produced pain in the face and sinus area, extrapolating that meningeal irritation that occurs during a migraine could be referred to the sinuses. He also established that stimulation in the sinus area caused referred pain and headache, thus opening the door to numerous theories about how the subjective sensation of pain may not always correlate with the physical location of its source within the body.

During the 1980s, 2 authors, Novak and Bonaccorsi, published multiple articles expounding the technique of using nasal surgery to improve headache, culminating in a prospective study looking at 299 patients with frequent or pharmacologically resistant migraine attacks and how they responded to sinonasal surgery. There was no strict surgical guideline in place, but examples of surgical procedures performed included septoplasty, ethmoidectomy, sphenoidotomy, and middle turbinate resection. Their results were an overall success rate of 90%, with 79% of patients "permanently asymptomatic" and another 11% only noting occasional pressure afterward. Unfortunately, there is no indication of what the timeline for follow-up was, or if there was any at all.[27]

In the mid-1990s, Clerico[28,29] published some small series and case reports with good results, but without any real standardization of inclusion/exclusion criteria, follow-up, or surgical procedure.

In 2000, Tosun et al.[30] carried out a prospective study that showed more specificity in their inclusion/exclusion criteria. Patients enrolled had chronic headache lasting at least 3 months; presence of contact points documented on endoscopy, CT, or both; failure of medical therapy directed at the headache; relief of headache after local anesthetic applied to contact points; and contact points that remained even after decongestion. Exclusion criteria included any inflammatory findings on thorough ENT exam including nasal endoscopy and CT scan, and the finding of any other obvious cause of headache (including migraine) after a thorough evaluation by neurology, ophthalmology, dentistry, and internal medicine. Following surgery directed at contact points in this very selective group of patients, they found improvement in 91% of patients, with 43% having complete relief and 47% having significant improvement. Unfortunately, again, there was no indication of what, if any, the follow-up time period was.

Welge-Luessen et al.[31] did a very interesting 10-year longitudinal prospective study looking at patients with a mean 18-year history of refractory migraine or cluster type headaches who were found to have endonasal contact points on endoscopy and a positive preoperative cocaine result (relief of headache with application of this anesthetic to the contact point). An impressive follow-up of an average of 112 months showed an overall success rate for surgical correction of contact points of 65%, with 6 patients completely free of pain, 7 with significant improvement, and 7 with no relief. Two patients had relief for 7 and 8 years, respectively, before the pain returned. However, it is unclear if this study was powered appropriately to give statistically significant results, with only 20 patients included.

Finally, in 2010, Yazici et al.[32] performed a prospective study looking at patients with primary headache of migraine or tension-type. Exclusion criteria included

TABLE 9. Summary of treatment of contact points in patients with sinus headache

Study	Year	Study design	Level of evidence	Number of subjects	Study groups	Surgical protocol	Primary endpoint	Conclusion
Novak and Makek[27]	1992	Prospective cohort	4	299	Frequent or pharmacologically resistant migraine	None specified	Subjective improvement	Surgery is a successful approach to patients with headache and mucosal contact points
Tosun et al.[30]	2000	Prospective cohort	4	30	Contact point with no other cause of headache	Directed to only address contact points	Subjective improvement	Surgery is a successful approach to patients with headache from no other cause and mucosal contact points
Welge-Luessen et al.[31]	2003	Prospective cohort	4	20	Refractory migraine or cluster headache with contact points	None specified	Subjective improvement	Surgery is a successful approach to patients with headache and mucosal contact points
Yazici et al.[32]	2010	Prospective cohort	4	73	Migraine or tension-type headache with contact points	None specified	Improvement on pain visual analogue scale	Some patients with primary headache and contact points benefit from nasal surgery

previous nasal surgery; clinical or radiologic evidence of allergic rhinitis, sinusitis, nasal polyps, or masses; and a nonresponsive mucosal contact point test. A total of 73 patients had the abovementioned rhinologic abnormalities. All patients were placed first on a headache-directed medical therapy, although the authors did not specify which medication was used or if there was a single- or multiple-drug regimen chosen. After 1 month, 53 patients had failed to respond to this medical therapy and were offered surgery. Fifteen patients declined due to lack of nasal symptoms. Patients were asked to rate the severity of headache on the visual analogue scale (VAS) preoperatively and then 3 and 6 months postoperatively. The decrease in VAS score for both 3 and 6 months compared to preoperative scores was statistically significant ($p < 0.01$). Six-month follow-up is a relatively short length of time, thus also bringing the quality of this study down in evidence level.

Of note, none of these studies reported an incidence of operative complications, and although we know that minor procedures such as those described above generally have a low rate of complication, it is not zero, and we have kept this in mind when formulating our summary. We have also kept in mind the IHS statement that controlled trials are recommended to validate mucosal contact-point headache as an unequivocal diagnosis. In spite of a low level of evidence, the preponderance of the literature surrounding this issue appears to show a benefit of directed nasal surgery to remove contact points in a highly selected patient population. Specifically, the patient population that appears to possibly benefit from directed nasal surgery are those who have contact points, have failed medical therapy directed at primary headache diagnoses such as migraine and tension-type headache by a neurologist, having otherwise normal endoscopy and CT scan, and having responded positively with regard to their headache when tested beforehand with local application of an anesthetic to the contact point. Even in this patient population it remains paramount to hold a lengthy discussion with respect to risks, benefits, and alternatives, with particular emphasis on the fact that surgery may not alleviate the facial pain and/or headache.

Summary: Nasal surgery for mucosal contact points in the patient with "sinus headache" (Table 9)

1. Aggregate level of evidence: C (Level 4: 4 studies).
2. Benefit: Although study design issues have been raised, there appears to be a highly selected patient population that may find relief of headache, after having failed all other options, with directed surgery to remove endonasal contact points.
3. Harm: As with all surgery, there come attendant risks. Patients are undergoing risk of anesthesia and associated risks of nasal surgery, such as infection, bleeding, septal perforation, formation of synechiae, etc.
4. Cost: High, as costs to the patient and/or insurance company include payment to the surgeon, the anesthesiologist, and the hospital or surgical center where the procedure takes place. However this is a 1-time expense, which should be compared to medication costs, with the knowledge that patients may need to be on medical therapy for the rest of their lives. Also, the expense of repeated CT scans will be eliminated, and time away from work will be removed.
5. Benefit-harm assessment: Likely balance of benefit and harm, although our assessment of harm is theoretical as it has not been proven in any study.

6. Value judgments: None.
7. Policy level: Option within the limited patient population of those patients with chronic headache, otherwise normal endoscopy and CT scan, positive headache response to application of local anesthetic, and failure to resolve after trial of migraine-directed medical therapy.

Evidence lacking

One key point covering almost all the studies outlined above is that the majority of them excluded patients who had any mucosal changes on CT. Although this clearly demonstrates the investigators' desire to avoid confounding factors in their study population, this is also the most likely subset of patients who may undergo unnecessary surgery. As at least 30% to 40% of the asymptomatic population shows some mucosal change on CT, the studies above have excluded the exact population deserving the most attention.

At least 1 study included above clearly showed that there can be coexistence of sinusitis and migraine,[21] and therein lies the difficulty. Multiple studies have looked at how well CT correlates with sinus symptoms, and although some have shown some correlation with degree of severity on CT scan and degree of pressure sensation,[33] the majority of studies have been able to show no correlation at all between grading of sinus CT and symptomatology.[34–37]

In spite of the multiple studies looking at that issue, there is a complete dearth of literature looking specifically at this subset of patients with self- or physician-diagnosed "sinus headache" and mild mucosal changes on CT. At this point we must simply accept this as an inherent weakness of our overall review of this topic, and note this is an indication that further study is necessary in this patient population.

Conclusion

This review evaluated the literature on the topic of "sinus headache," most often occurring in the absence of significant sinonasal inflammatory changes. Again, the intent of this review is not to supplant clinical judgment, and all causes of headache, including tumors, prior trauma, iatrogenic sources, sinus disease, other inflammatory conditions such as temporomandibular joint disorders, and other headache disorders must be considered in the differential diagnosis.

An evidence-based approach to the patient with self- or physician-diagnosed sinus headache is to perform a thorough head and neck evaluation of the patient, including neurologic exam, nasal endoscopy, and CT scan, evaluate with IHS criteria, and preserve a high clinical suspicion for migraine, as this has been shown to be the most likely diagnosis in this subset of patients.

In addition, in the patient population that does have a nasal endoscopy and CT scan showing no signs of sinonasal inflammation, a migraine-directed therapy, such as a triptan, should be the next step in therapy. Not only has this been shown to benefit the majority of this patient population, but it has also been shown to help prove the diagnosis of migraine in these patients, as long as physicians keep in mind the potent vasoconstrictive effects of triptans and all possible diagnoses this property may benefit.

If a patient has nasal endoscopy and CT scan indicating sinus disease, this should be treated appropriately. The approach to appropriate treatment of acute or chronic sinusitis is beyond the scope of this review.

For patients presenting with sinus headache who have no other obvious cause of headache, have already failed medical treatment directed at migraine, and show contact points on endoscopy or CT scan but no other signs of inflammation, directed nasal surgery to address these contact points may be an option.

As evident by the array of studies performed by both otolaryngologists and neurologists on this topic, headaches exhibiting autonomic symptoms in the sinonasal region are not currently well understood. There appears to be a complex interplay between affective and effective neuronal pathways in this vicinity, and it still remains unclear whether the brain and meninges or the sinonasal region is the initiating trigger in the pathway leading to the typical symptoms. Although this indicates a need for further basic science research elucidating these pathways, as well as better clinical research including RCTs, we can feel justified in using what evidence we currently have to effectively diagnose and treat these patients.

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