



Sinus migraine: A systematic review and meta-analysis

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Supplementary Table 1. Characteristics of Group 1 Studies

Study ID	Author	Year	Country	Journal	Study design	Study period/ follow up period	Mono or multicenter	Mean age (years)	Female%
Study 1	Abdelgafour	2025	Sudan	The Egyptian Journal of Otolaryngology	Cross-sectional hospital-based study	July 2022 to February 2023	monocenter	33 ± 10	65.50
Study 2	Mustafa Kaymakç	2014	Turkey	Eastern Journal of Medicine	prospective	The mean follow-up was 3.2 months (range, 4-16 weeks)	monocenter	41 (23-63)	30.70
Study 3	Mohsen Foroughipour	2011	Iran	Eur Arch Otorhinology	prospective cross-sectional	September 2006 to September 2007	multicenter	33 ± 11	62
Study 4	Kari E	2009	United States	The Laryngoscope	Prospective	follow up period 1-3 months	monocenter	41 (23-70)	67
Study 5	Mehle ME	2008	United States	Headache	prospective	-	monocenter	-	-
Study 6	Eross	2007	United States	Headache	descriptive clinical study	-	multicenter	51 (14.5)	78
Study 7	Brian F. Perry	2004	United States	Otolaryngology-Head and Neck Surgery	Prospective	from March 2000 to June 2002	monocenter	greater than 18	-
Study 8	Schreiber	2004	North America (United States and Canada)	Archives of Internal Medicine	Cross-sectional study	-	multicenter	18 to 65, 39.3 (10.9)	77



Supplementary Table 1. Characteristics of Group 1 Studies, Continued

Study ID	Method of headache/migraine diagnosis	Symptoms	Headache characteristics	Medication use
Study 1	IHS criteria	Nasal blockage: 178 (90.4%); Facial pain: 87 (44.7%); Nasal discharge: 42 (21.3%); Hyposmia: 31 (15.7%); Anosmia: 5 (2.5%); Epistaxis: 2 (1%); Autonomic symptoms: Lacrimation: 71 (36%); Conjunctival injection: 20 (10%); Eyelid edema: 6 (3%).	160 (81.2%) experienced 5 or more attacks; 127 (64.5%) lasted 4 to 72 hours; 111 (56.3%) sudden onset; 86 (43.7%) gradual; Unilateral: 93 (47.2%); Bilateral: 104 (52.8%); Severity (NRS): Mild: 66 (33.5%); Moderate: 72 (36.5%); Severe: 59 (29.9%); Pulsating: 67 (34%); Aching: 130 (66%); Aggravated by physical activity: 95 (48.3%); Bending forward: 85 (29.4%); Aura (visual spots/flashes): 37 (18.8%); Tingling/numbness: 37 (18.8%); Slow speech: 5 (2.5%); Nausea: 85 (43.1%); Vomiting: 20 (10%); Photophobia: 48 (24.4%); Phonophobia: 16 (8.1%).	NSAIDs: 104 (52.8%); Responders: 50 (48%); Nasal sprays: 67 (36%); Responders: 31 (46%); Antimigraine medications: 17 (8.6%); Responders: 6 (35%).
Study 2	IHS criteria	46.1% of patients suffered from nasal congestion, 30.7% from rhinorrhea, 7.6% from vertigo, 76.5% from sinus sensitivity and 7.6% from blurred vision. Additional nasal pathology was present in 21 (80.7%) of the patients with headache, and 22 (84.6%) had headache accompanied by nasal obstruction. The most common nasal pathology was septal deviation (65.3%). Purulent nasal discharge was present in 17 (65.3%) patients, mucocoele in four (15.3%), fungal sinusitis in two (7.6%) and nasal polyposis in seven (26.9%). The most commonly blocked sinus was the maxillary sinus (80.7%).	Pain most commonly as located in the frontal and maxillary regions, as well as in the periorbital region (26.9%). 73% described their pain as throbbing. 82% of patients described their headache as a sudden-onset pain and 65.3% suffered from bilateral pain.	-
Study 3	IHS criteria	Nasal congestion was observed in 100% of patients with sinusitis, 50% with tension-type headache and 48% with migraine. The most common triggering factors for headache were coldness, stress, insomnia and sunlight. The most common aggravating factors were head bending (74%) and physical activity (67%).	The mean duration of headache onset was 70 months and the mean duration of each headache episode was 12 h. 54% of patients had a positive family history of headache affecting first-degree relatives. The most common site of headache was the frontal region; the whole of the head, the vertex and the temporal region were the three next most common sites of pain. The quality of headache was throbbing in 66% of patients, crushing in 58%, burning in 9% and vague in 5%. The most common accompanying features of headache were sinus tenderness (70%), phonophobia (67%), photophobia (62%) and postnasal discharge (39%).	A total of 73% of patients with a final diagnosis of tension-type headache and 66% with a final diagnosis of migraine had received recurrent antibiotic therapy and 96% of all patients had received antibiotic therapy at least once during treatment given prior to the study. Surprisingly, therapeutic nasal septoplasty had been performed in 16% of patients with a final diagnosis of migraine, 13% with a final diagnosis of tension-type headache and 0% with true recurrent sinusitis.
Study 4	IHS criteria	-	-	Triptans
Study 5	IHS criteria	Congestion, nasal discharge, itching, sneezing, postnasal drip	-	-
Study 6	ICHD-II, A detailed headache history and a complete general and neurological examination were performed in each subject by a neurologist specializing in headache.	Pain located over the sinuses (98%), pain triggered by changes in the weather (83%), pain associated with rhinorrhea (73%), and the diagnosis suggested by a previous physician (78%). The 63 migraine subjects reported a medical history of allergic rhinitis (54%), prior acute rhinosinusitis (76%), and chronic rhinosinusitis (14%).	The mean frequency of migraine headache days per month was 14.3 (range 2 to 30). The mean headache duration was 40.5 hours with a mean time to peak pain intensity (T-max) of 105 minutes (range 10 to 480 minutes). The mean pain severity was 6.7 on an ordinal 0–10 scale (range 4 to 10).	Ninety-five percent of the 63 subjects were taking medications for the treatment of their headaches. Nonsteroidal anti-inflammatory drugs (NSAIDs; 33%) were the most common followed by acetaminophen (25%), OTC combination headache analgesics (21%), and OTC combination sinus medications (21%). Triptans were utilized by 9.5%. Based upon indications and contraindications, 92% of subjects were candidates for triptans, but only 12% were utilizing them. Despite their infrequent use, triptans received the highest efficacy rating (average 2.2) followed by narcotics (1.5) and antihistamines (1.4).
Study 7	20-Item Sino-Nasal Outcomes Test (SNOT-20) scores	-	-	-
Study 8	IHS, experienced at least 6 self-described or physician-diagnosed "sinus" headaches during the 6 months before screening.	The most common symptoms were sinus pressure (84%), sinus pain (82%), and nasal congestion (63%).	Mean no. of sinus headaches episodes per month = 3.3 (2.9). Sinus pain: mild in 3%, moderate in 51%, severe in 47%. Migraine like symptoms: moderate/severe pain 97%, pulsing/throbbing 89%, worsened by activity 85%, photophobia 79%, nausea 73%, phonophobia 67%, unilateral 57%, aura 28%, vomiting 24%. Sinus-like symptoms: sinus pressure 84%, sinus pain 82%, nasal congestion 63%, runny nose 40%, watery eyes 38%, itchy nose 27%.	Nonnarcotic analgesics (1770, 74%), NSAIDs (1733, 72%), decongestants (1349, 56%), anti-histamines (1144, 48%), combination drugs (762, 32%), narcotic analgesics (339, 14%).



Supplementary Table 1. Characteristics of Group 1 Studies, Continued

Study ID	Inclusion and exclusion criteria	Summary	Conclusion
Study 1	Included any adult older than 18 years and presenting with self-reported or physician diagnosed headache along with sinonasal symptoms. Exclusion criteria: Patients with a suspected secondary cause of headache including patients with a confirmed malignancy, granulomatous disease including nasal tuberculosis, syphilis etc. Patients with a previous diagnosis of migraine. Evidence of sinus infections during the past six months. Patients who refuse participating.	This cross-sectional study aimed to determine the prevalence of migraine among patients presenting with sinus headache at Khartoum ENT Hospital. The study included 197 patients with a mean age of 33 years, and 65.5% were female. The prevalence of migraine was found to be 34%, with 20% experiencing migraine without aura and 14% with aura. Migraine was significantly associated with autonomic symptoms, a positive family history of migraine, and poor response to NSAIDs and nasal sprays compared to non-migraine headache.	Migraine is not uncommon among patients with sinus headache symptoms. It is associated with autonomic symptoms and a positive family history of migraine. Response to antimigraine medications can aid in diagnosing migraine.
Study 2	Inclusion criteria: patients with sinus headache Endoscopic examination and PCT data for these patients with chronic rhinosinusitis (CRS), who underwent sinus surgery and attended regular check-ups until the conclusion of the study, were examined. Exclusion criteria were atypical infection, malignancy, acute rhinosinusitis exacerbation and ciliary dysmotility.	This study aimed to examine the prevalence and etiological causes of sinus headache in patients with chronic rhinosinusitis. Patients who complained of sinus headache were identified and their presenting symptoms were analyzed in the light of the final diagnosis, after surgical treatment and follow-up.	Sinonasal surgery may be beneficial in patients with CRC and headaches, however sometimes primary headache, most often migraine, accompany sinonasal pathology. Therefore treatment for patients diagnosed with chronic sinusitis and complaining of headache must be determined in consultation with the neurology clinic.
Study 3	Inclusion criteria: were those who had previously been diagnosed as having sinus headache and treated several times without significant improvement. The exclusion criteria: previous diagnosis of migraine or tension-type headache; imaging evidence of sinus infection during the past 6 months; or the presence of any of fever, purulent/discholorated nasal discharge or purulent postnasal discharge in association with headaches.	The study highlights that a significant number of patients diagnosed with "sinus headache" by primary care physicians actually have migraine or tension-type headache. The findings suggest that a thorough clinical evaluation, including otorhinolaryngologic and neurologic assessments, is crucial to accurately diagnose the underlying cause of headache. This can help avoid unnecessary treatments and improve patient outcomes.	Many patients with self-described or primary care physician labeled "sinus headache" have no sinonasal abnormalities. Instead, most of them meet IHS criteria for migraine or tension-type headache.
Study 4	Inclusion criteria were as follows: primary complaint of facial pain, pressure, or headache localized over the area of the paranasal sinuses, a self or physician diagnosis of "sinus headache," clinical examination including rigid nasal endoscopy that was negative for findings of sinusitis, and CT scan that was negative for findings of sinusitis. CT scans need to be performed within 6 months of entry into the study and be interpreted as normal or minimal disease that was not clinically significant. Contraindications to enrollment were as follows: patient had contraindications to use of triptans (coronary artery disease, vasospasm, Raynaud's disease, mitral valve prolapse, tachycardia, and previous adverse reaction to triptan medications) or there existed other identifiable causes of their headache. A previous diagnosis of migraine headache or previous treatment for migraine was not a contraindication (but those were not having previous diagnosis of migraine separated and counted) to participation in this study. Patients who had previously undergone sinus surgery were also included if they meet the other criteria for inclusion.	This prospective clinical trial investigated the efficacy of triptans in treating patients with self-described "sinus headaches" who do not have sinusitis confirmed by endoscopy or CT scan. The study found that 82% of these patients experienced significant pain reduction with triptan use, suggesting that many "sinus headaches" may actually be migraines. The response to triptans can aid in differentiating between true sinus headaches and migraines.	Our findings highlight the importance of considering migraine headaches in the differential diagnosis of patients presenting with "sinus headaches" in the context of negative clinical and radiographic evidence.
Study 5	-	This study evaluated the sinus CT scan findings in "sinus headache" migraineurs, and to compare the findings to nonmigraine "sinus headache" patients. The majority of "sinus headache" patients satisfy the IHS criteria for migraine. Surprisingly, these patients often have radiographic sinus disease. This raises the possibility of selection bias in otolaryngology patients, inaccurate diagnosis, or radiographic sinus disease and migraine as comorbid conditions. Positive migraine histories apparently do not obviate the need for a thorough ENT workup, possibly including CT scanning.	-
Study 6	All subjects who believed they suffered from sinus headache and were over 18 years of age were enrolled.	This study investigates the prevalence of migraine among patients with a history of self-reported or physician-diagnosed sinus headache, finding a high prevalence of migraine in this population.	The majority of those with self-diagnosed sinus headache have migraine or probable migraine. In those patients with migraine, the most common reasons for misdiagnosis include headache triggers, pain location, and associated features ("guilt by provocation, location, and association") commonly attributed to sinus headache. The clinician must be aware of these unique presentations of migraine so that a correct diagnosis can be made and effective treatment instituted. A portion of patients with self-diagnosed sinus headache suffer from a headache type, which is unclassifiable by the current IHS criteria. These headaches are characterized by bilateral maxillary pressure, mild to moderate pain intensity, cranial autonomic symptoms, and the complete absence of migraine features.



Study 7	<p>Inclusion criteria included patients greater than 18 years of age, literate in English, referred by a physician for primary complaint of "sinusitis," and major symptomatic complaint of headache or facial pain/pressure. Exclusion criteria included evidence of chronic rhinosinusitis, a modified Lund-Mackay score greater than 2, pregnancy, history of prior facial trauma or tumor in the head and neck region, and past history of autoimmune disorder affecting the head and neck region.</p>	<p>This study aimed to determine the etiology of headache in patients referred for sinus evaluation but found to have no evidence of rhinosinusitis on CT scans and endoscopic examination. Data were collected prospectively from 100 patients with headache but normal sinus CT and endoscopic examination. The study compared the headache and Sino-Nasal Outcomes Test (SNOT-20) scores of patients with the chief complaint of headache requiring further neurologic evaluation (Group I) with those who had mild headache (Group II) and those without headache (Group III).</p>	<p>The most common neurologic diagnosis in Group I patients was migraine headaches (58%). These patients also had higher mean SNOT-20 scores (24 ± 3.3) compared to Group I (14.6 ± 2.3) and Group III (12.4 ± 2.1), indicating greater disability in their overall quality of life. The study concluded that migraine is the most common type of headache in patients with normal sinus CT treated for presumed rhinosinusitis. Patients with severe headache, especially those not responding to medical therapy for rhinosinusitis, should be referred for definitive diagnosis and treatment by a neurologist.</p>
Study 8	<p>Patients with a history of "sinus" headache, no previous diagnosis of migraine, and no evidence of infection were assigned an IHS headache diagnosis on the basis of headache histories and reported symptoms. Exclusion criteria included prior diagnosis of migraine or use of triptans; radiographic evidence of sinus infection within the past 6 months; and the occurrence of fever or purulent/discolored nasal discharge indicative of infection or postnasal drainage with their self-described "sinus" headaches.</p>	<p>This study found that 80% of patients with a history of self-reported or physician-diagnosed "sinus" headache met the criteria for migraine according to the International Headache Society (IHS) during their screening visit.</p>	<p>In this study, 88% of patients with a history of "sinus" headache were determined to have migraine-type or suspected migraine headache. In patients with recurrent headaches without fever or purulent discharge, the presence of sinus-area symptoms may be part of the migraine process. Migraine should be included in the differential diagnosis of these patients.</p>



Supplementary Table 2. Characteristics of Group 2 Studies

Study ID	Author	Year	Country	Journal	Study design	Study period	Mono or multicenter	Mean age	Female%
Study 1	Louloua Al Kadri	2025	Syria	Medicine	case-control study	-	monocenter	23.8	79.9
Study 2	Mustafa Kaymakci	2013	Turkey	Journal of International Medical Research	prospective	between February 2012 and May 2012	multicenter	44 years (range 17–63 years)	73
Study 3	Jasem Y Al-Hashel	2013	Kuwait	The Journal of Headache and Pain	retrospective	between 2010 and 2012	multicenter	35.88 ± 9.87	76.90
Study 4	Gary Ishkanian	2007	USA	Clinical Therapeutics	Randomized Controlled Trial	From November 2001 to March 2002	multicenter	18-65	70

Supplementary Table 2. Characteristics of Group 2 Studies, Continued

Study ID	Method of headache/migraine diagnosis	Symptoms	Headache characteristics
Study 1	The Migraine Screening Questionnaire and SinoNasal Outcome Test 22.	Nasal obstruction, the need to blow the nose, ear pain, ear fullness, or pain in facial bones.	54.9% of the students reported experiencing severe and frequent headaches, and 49.9% reported a headache lasting more than 4 hours. In addition, 13.5% evaluated the severity of their headaches during the past 2 weeks as 5 on a scale of 0 to 10.
Study 2	IHS criteria	The following symptoms were observed: nasal congestion in 27 (28%) patients; rhinorrhoea in 15 (15%) patients; vertigo in three (3%) patients; photophobia or phonophobia in 67 (68%) patients; nausea and/or vomiting in 18 (18%) patients; sinus sensitivity in 75 (77%) patients; blurred vision in 29 (30%) patients. A total of 90 (92%) patients presented with at least one symptom such as nasal obstruction, nasal discharge or sinus sensitivity.	Patients described their pain localizing most commonly in the frontal and temporal regions, and unilaterally in the periorbital region. With respect to the different types of pain reported, 71 (72%) patients described their pain as throbbing and 64 (65%) patients as crushing, 23 (23%) patients complained of a burning pain and five (5%) patients had a 'vague-type' of pain. Eighty-one (83%) patients described their headache as a sudden-onset pain and 27 (28%) patients reported the pain as bilateral.
Study 3	ICHD-III-beta	The symptoms referred to the sinus areas were: sinus pain (76.2%), sinus pressure (60%) and nasal congestion (55.4%).	
Study 4	IHS criteria	Sinus and nasal symptoms included runny nose, nasal congestion, sinus pain, sinus pressure, watery eyes, itchy nose, postnasal drip, and sneezing. Symptoms reported related to migraine: nausea, vomiting, photophobia, phonophobia.	129/215 having unilateral pain, 173/215 having throbbing pain, 153/215 having pain worsen with physical activity.



Supplementary Table 2. Characteristics of Group 2 Studies, Continued

Study ID	Conclusion	Summary	Inclusion and exclusion criteria
Study 1	The results of this study indicate that the diseases and symptoms of the nose and sinuses are significantly associated with migraine. Healthcare providers must raise awareness about this relationship for further evaluation and research and for early provision of the appropriate advice and treatment to improve patient's quality of life and minimize disability.	The study included 963 students, of whom 417 were cases who had migraines and 546 were controls who did not. Most sino-nasal diseases are related to migraines. The results of this study indicate that the diseases and symptoms of the nose and sinuses are significantly associated with migraine.	The inclusion criteria included students at the SPU who were between 18 and 50 years old. The exclusion criteria included students under 18 or over 50 years of age, participants who were not students at SPU, students with acute or chronic illnesses, and students undergoing long-term treatments.
Study 2	A better understanding of vascular event-derived headaches (especially migraine) and a detailed examination of patients via endoscopy and CT scanning are expected to minimize misdiagnosis rates, in patients with sinus headaches.	Patients with sinus headaches usually complain of pain and pressure sensation around the sinuses and periorbital area; most are misdiagnosed with sinusitis and receive unnecessary treatment. This prospective study investigated the etiology of sinus headache in patients with negative endoscopic or computed tomography (CT) scan findings.	Consecutive patients who could be followed regularly after being admitted to either otorhinolaryngology outpatient or emergency units because of sinus headache, and in whom subsequent endoscopic and radiological examinations did not reveal any sinonasal pathology, were included in the study. The exclusion criteria were as follows: acute rhinosinusitis exacerbation within the previous 6 months; any signs of an ongoing infection (such as purulent nasal discharge or fever); sinonasal polypsis; any previous sinus or nasal surgery; evidence of mucosal contact points in paranasal CT scans; septal deviation; any concha pathologies.
Study 3	Many migraine patients were misdiagnosed as sinusitis. Strict adherence to the diagnostic criteria will prevent the delay in migraine diagnosis and help to prevent chronification of the headache and possible MOH (medication overuse headache).	A total of 130 migraine patients were recruited. Of these patients 106 (81.5%) were misdiagnosed as sinusitis. The mean time delay of migraine diagnosis was (7.75 ± 6.29) , range 1 to 38 years). Chronic migraine was significantly higher ($p < 0.02$) in misdiagnosed patients than in patients with proper diagnosis. Medication overuse headache (MOH) was reported only in patients misdiagnosed as sinusitis. The misdiagnosed patients were treated either medically 87.7%, or surgically 12.3% without relieve of their symptoms in 84.9% and 76.9% respectively. However, migraine headache improved in 68.9% after proper diagnosis and treatment.	Exclusion criteria included radiographic evidence of sinus infection, the occurrence of fever, or purulent nasal discharge associated with their headaches within the past six months of evaluation. Patients who were unable to give reliable information about their medical history and headache characteristics or have incomplete medical files were excluded from the study.
Study 4	Sumatriptan 50-mg tablets were effective and generally well tolerated in the treatment of these patients presenting with migraine headaches that were self-described or physician-diagnosed as sinus headaches.	A randomized, double-blind, placebo-controlled, multicenter study was conducted in adult (aged 18-65 years) migraine patients presenting with self-described or physician-diagnosed "sinus" headache. From November 2001 to March 2002, patients meeting International Headache Society criteria for migraine to receive either 1 sumatriptan 50-mg tablet or matching placebo tablet. The primary efficacy end point was headache response (moderate or severe headache pain reduced to mild or no headache pain) at 2 hours after administration. The presence or absence of migraine-associated symptoms and sinus and nasal symptoms was also measured. Tolerability was assessed through patient-reported adverse events.	To exclude patients with an existing acute infectious process, those with radiographic evidence of sinus infection within the previous 3 months, fever, and/or purulent or discolored nasal discharge indicative of an infection were not allowed to participate.