

**Headache
EVIDENCE TABLE**

Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Study Quality
1. Silberstein SD, Lipton R, Goadsby PJ. Headache in Clinical Practice. In: olesen J, Tfelt-Hansen P, Welsch KMA, eds. <i>The Headaches</i> . 2nd ed. Philadelphia, PA: Lippincott, Williams & Wilkins; 2000.	Review/Other-Dx	N/A	Book chapter.	No abstract available.	4
2. Stovner L, Hagen K, Jensen R, et al. The global burden of headache: a documentation of headache prevalence and disability worldwide. <i>Cephalalgia</i> 2007; 27(3):193-210.	Review/Other-Dx	N/A	To assess and present all existing evidence of the world prevalence and burden of headache disorders.	Globally, the percentages of the adult population with an active headache disorder are 46% for headache in general, 11% for migraine, 42% for tension-type headache and 3% for chronic daily headache. The study calculations indicate that the disability attributable to tension-type headache is larger worldwide than that due to migraine. On the World Health Organization's ranking of causes of disability, this would bring headache disorders into the 10 most disabling conditions for the two genders and into the five most disabling for women.	4
3. Stovner LJ, Andree C. Prevalence of headache in Europe: a review for the Eurolight project. <i>J Headache Pain</i> 2010; 11(4):289-299.	Review/Other-Dx	N/A	To update studies on headache epidemiology as a preparation for the multinational European study on the prevalence and burden of headache and investigate the impact of different methodological issues on the results.	More than 50% of adults indicate that they suffer from headache in general during the last year or less, but when asked specifically about tension-type headache, the prevalence was 60%. Migraine occurs in 15%, chronic headache in about 4% and possible medication overuse headache in 1%-2%. Cluster headache has a lifetime prevalence of 0.2%-0.3%. Most headaches are more prevalent in women. As to methodological issues, lifetime prevalence's are in general higher than 1-year prevalence's, but the exact time frame of headache (1 year, 6 or 3 months, or no time frame stated) seems to be of less importance.	4
4. King S, Chambers CT, Huguet A, et al. The epidemiology of chronic pain in children and adolescents revisited: a systematic review. <i>Pain</i> 2011; 152(12):2729-2738.	Review/Other-Dx	41 articles	Systematic review was performed to examine studies of chronic and recurrent pain prevalence to provide updated aggregated prevalence rates. The review also examined correlates of chronic and recurrent pain such as age, sex, and psychosocial functioning.	Prevalence rates ranged substantially, and were as follows: headache: 8%-83%; abdominal pain: 4%-53%; back pain: 14%-24%; musculoskeletal pain: 4%-40%; multiple pains: 4%-49%; other pains: 5%-88%. Pain prevalence rates were generally higher in girls and increased with age for most pain types.	4

**Headache
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5. Lipton RB, Stewart WF. The epidemiology of migraine. <i>Eur Neurol</i> 1994; 34 Suppl 2:6-11.	Review/Other-Dx	N/A	Estimates of migraine prevalence are reviewed.	Studies using International Headache Society (IHS) diagnostic criteria have given relatively consistent estimates of migraine prevalence (about 15%-18% of women and 6% of men) and indicate that migraine occurs most commonly in men and women aged 25-55 years.	4
6. Lyngberg AC, Rasmussen BK, Jorgensen T, Jensen R. Incidence of primary headache: a Danish epidemiologic follow-up study. <i>Am J Epidemiol</i> 2005; 161(11):1066-1073.	Observational-Dx	549 persons participated	To assess the incidence of migraine and tension-type headache in Denmark by conducting a 12-year follow-up study of a general population (1989-2001).	The incidence of migraine was 8.1 per 1,000 person-years (male:female ratio, 1:6), and the incidence of frequent tension-type headache was 14.2 per 1,000 person-years (male:female ratio, 1:3). Both rates decreased with age. The incidence of migraine was higher than that previously calculated from cross-sectional studies. Risk factors for migraine were familial disposition, no vocational education, a high work load, and frequent tension-type headache. For tension-type headache, risk factors were poor self-rated health, inability to relax after work, and sleeping few hours per night. The gender difference for tension-type headache differed from that for migraine, and no association with educational level was observed.	4
7. Barea LM, Tannhauser M, Rotta NT. An epidemiologic study of headache among children and adolescents of southern Brazil. <i>Cephalalgia</i> 1996; 16(8):545-549; discussion 523.	Observational-Dx	538 students	A cross-sectional study of a randomized and proportional sample of male and female students, 10 to 18 years old was conducted to study the epidemiology of pediatric headache.	The following headache prevalence's were found: lifetime, 93.2%; last year, 82.9%; last week, 31.4%; last 24 h, 8.9%. Last week and last 24 h headache complaints were twice as prevalent in the female group. During the last year the prevalence of headache disorders was 72.8% for tension-type and 9.9% for migraine headache and was not associated with age distribution. Only the last year and last week prevalence's of tension-type headache were significantly higher in the female group. The last year prevalence of headache disorders proved to be positively associated with sex and age variables.	4

**Headache
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8. Kryst S, Scherl E. A population-based survey of the social and personal impact of headache. <i>Headache</i> 1994; 34(6):344-350.	Observational-Dx	647 persons	To explore the social and personal impact of headache.	The 12-month period prevalence for all serious headaches was 13.4%; for migraine, it was 8.5%. Demographically, there was a higher proportion of headache sufferers in the low income bracket (< \$10,000/year) and a higher proportion of women reporting migraines. Of those with serious headaches, 73.6% stated that headaches adversely affected their lifestyle in at least one way. Migraineurs reported significantly more interference in family relations, work attendance, and work efficiency than non-migraineurs. Women said their family relationships and work productivity were impacted significantly more often than men. Of those reporting disability, 46.8% said they take only non-prescription medications.	4
9. Merikangas KR, Whitaker AE, Isler H, Angst J. The Zurich Study: XXIII. Epidemiology of headache syndromes in the Zurich cohort study of young adults. <i>Eur Arch Psychiatry Clin Neurosci</i> 1994; 244(3):145-152.	Observational-Dx	379 subjects	To examine the 1-year prevalence rates of headache syndromes in young adults ages 29-30.	The 1-year prevalence rates were 3.3% for migraine with aura and 21.3% of migraine without aura. Despite the substantial degree of impairment in occupational and social functioning that was associated with migraine, an extremely low proportion of subjects had received professional treatment for headache. These results suggest that a concerted effort should be directed towards education regarding the classification of headache and the availability of efficacious treatment for migraine.	3
10. Wong TW, Wong KS, Yu TS, Kay R. Prevalence of migraine and other headaches in Hong Kong. <i>Neuroepidemiology</i> 1995; 14(2):82-91.	Observational-Dx	311 patients with recurrent headache successfully interviewed; 101 were clinically validated	To determine the prevalence of headache in the Hong Kong population.	Overall prevalence rates were 1% for migraine, 2% for tension-type headache and 1% for unclassified headache. Adjusted for misclassification and non-response, the estimated prevalence rates for the 3 categories were 1.5%, 3% and 0.4%, respectively.	4

Headache
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11. O'Brien B, Goeree R, Streiner D. Prevalence of migraine headache in Canada: a population-based survey. <i>Int J Epidemiol</i> 1994; 23(5):1020-1026.	Observational-Dx	2,922 adults	To estimate the prevalence of migraine headache among Canadian adults (aged ≥ 18 years), using the IHS classification.	The prevalence of migraineurs, headaches and non-headaches among males was 7.8%, 76.1%, and 16.1% and among females was 24.9%, 65.6%, and 9.4%. For females prevalence appears to increase with age, peaking at 40-44 years and declining thereafter. Authors found no association between migraine prevalence and household income. Of 500 people classified by IHS criteria as migraineurs only 232 (46%) reported any migraine diagnosis by a physician. The authors estimate that 2.6 million adult females and 0.8 million adult males in Canada are migraineurs, but only half are likely to have been diagnosed by a physician.	4
12. Russell MB, Rasmussen BK, Thorvaldsen P, Olesen J. Prevalence and sex-ratio of the subtypes of migraine. <i>Int J Epidemiol</i> 1995; 24(3):612-618.	Observational-Dx	3,000 males and 1,000 females	To provide the prevalence and sex-ratio in Denmark of subtypes of migraine diagnosed by neurological interview according to the criteria of the IHS.	Lifetime prevalence's of migraine without aura, migraine with aura, migraine aura without headache, and migrainous disorder were 8%, 4%, 1% and 1% in males and 16%, 7%, 3% and 2% in females. Overall lifetime prevalence of any type of migraine was 18%; 12% in males and 24% in females. This is lower than the sum of the prevalence's since migraine diagnoses are not mutually exclusive. The male:female ratios of migraine without aura, migraine with aura, migraine aura without headache, and migrainous disorder were approximately 1:2. Migraine is more prevalent than previously thought. There was a significant preponderance in females of all the subtypes of migraine except migrainous disorder.	4
13. van de Ven RC, Kaja S, Plomp JJ, Frants RR, van den Maagdenberg AM, Ferrari MD. Genetic models of migraine. <i>Arch Neurol</i> 2007; 64(5):643-646.	Review/Other-Dx	N/A	To review genetic migraine models.	Genetic migraine models will help reveal the triggering mechanisms for migraine attacks and identify novel migraine prophylactic targets and therapies.	4

**Headache
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14. Stewart WF, Wood C, Reed ML, Roy J, Lipton RB. Cumulative lifetime migraine incidence in women and men. <i>Cephalalgia</i> 2008; 28(11):1170-1178.	Observational-Dx	120,000 US households	To estimate lifetime sex and age-specific incidence of migraine. Data are from the American Migraine Prevalence and Prevention study, a mailed survey sent to 120,000 U.S. households.	Cumulative incidence was 43% in women and 18% in men. Median age of onset was 25 years among women and 24 years among men. Onset in 50% of cases occurred before age 25 and in 75% before age 35 years. 4/10 women and 2/10 men will contract migraine in their lifetime, most before age 35 years. The incidence estimates from this analysis are consistent with those reported in previous longitudinal studies.	4
15. Jordan JE, Ramirez GF, Bradley WG, Chen DY, Lightfoote JB, Song A. Economic and outcomes assessment of magnetic resonance imaging in the evaluation of headache. <i>J Natl Med Assoc</i> 2000; 92(12):573-578.	Observational-Dx	328 patients	Retrospective review to determine the diagnostic and cost utility of MRI in patients with non-acute headache and non-focal neurologic examinations.	163 patients (50%) had negative MRI test results. Of the 50% of patients with positive studies, only 5 (1.5%) had clinically significant MRI results. The average cost of an MRI was \$517 (1998 dollars). The cost per clinically significant managed case detected was \$34,535. No statistically significant difference was found among referring specialties and clinically significant MRI results. Results indicate that MRI of nonfocal headache yields a low percentage of positive clinically significant results and has limited cost-effectiveness.	4

**Headache
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16. Tsushima Y, Endo K. MR imaging in the evaluation of chronic or recurrent headache. <i>Radiology</i> 2005; 235(2):575-579.	Observational-Dx	306 patients	Retrospective chart review and literature review to determine the likelihood of MRI depicting an abnormality in patients with chronic headache and no neurologic abnormality.	169 patients (55.2%) were placed in the first group, 135 (44.1%) were placed in the second group, and two (0.7%) were placed in the third group because they had a clinically important abnormality at MRI. Neither contrast material enhancement (n=195) nor repeated MRI (n=23) contributed to the diagnosis. Literature review revealed 2 previous studies concerning unspecified headache (in addition to the current study), including a total of 1,036 MRI results and 22 (2.1%) clinically important results (upper 99.5% confidence bound, 3.4%). 12 studies of migraine headache were found, with a total of 790 MRI examinations. Excluding the 19 patients with complicated migraine, the 99.5% confidence bound of the frequency of clinically important abnormality at MRI was estimated as 0.68%. Clinically important infarctions were noted on MRIs in 5 (26.3%) of 19 patients with complicated migraine. MRI is an unrewarding technique in the evaluation of patients with chronic or recurrent headache and normal neurologic findings.	4
17. Nawaz M, Amin A, Qureshi AN, Jehanzeb M. Audit of appropriateness and outcome of computed tomography brain scanning for headaches in paediatric age group. <i>J Ayub Med Coll Abbottabad</i> 2009; 21(1):91-93.	Review/Other-Dx	100 patients	To assess the appropriateness and outcomes of CT brain scanning for headaches in pediatric age group.	Only 4% of patients showed abnormal findings on CT scan while the remaining 96% of the scans were absolutely normal. The 4 patients with abnormal findings all had sinusitis, no notorious lesions. This audit suggests that a proportion of the CT studies performed for children with isolated headaches or common/classic migraine may have been inappropriate. The development of a local guideline for imaging referral is indicated.	4

Headache
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18. Gilbert JW, Johnson KM, Larkin GL, Moore CL. Atraumatic headache in US emergency departments: recent trends in CT/MRI utilisation and factors associated with severe intracranial pathology. <i>Emerg Med J</i> 2011.	Observational-Dx	15,062 patient records	To estimate recent trends in CT/MRI utilization among patients seeking emergency care for atraumatic headache in the USA and to identify factors associated with a diagnosis of significant intracranial pathology in these patients.	Between 1998 and 2008 the percentage of patients presenting to the ED with atraumatic headache who underwent imaging increased from 12.5% to 31.0% (P<0.01) while the prevalence of intracranial pathology among those visits decreased from 10.1% to 3.5% (P<0.05). The length of stay in the ED was 4.6 hours (95% CI: 4.4 to 4.8) for patients with headache who received imaging compared with 2.7 (95% CI: 2.6 to 2.9) for those who did not. Of 18 factors evaluated in patients with headache, 10 were associated with a significantly increased odds of an intracranial pathology diagnosis: age \geq 50 years, arrival by ambulance, triage immediacy <15 minutes, systolic blood pressure \geq 160 mm Hg or diastolic blood pressure \geq 100 mm Hg and disturbance in sensation, vision, speech or motor function including neurological weakness.	4
19. Kernick DP, Ahmed F, Bahra A, et al. Imaging patients with suspected brain tumour: guidance for primary care. <i>Br J Gen Pract</i> 2008; 58(557):880-885.	Review/Other-Dx	N/A	Review guidance for imaging of patients with suspected brain tumor.	Study suggests management for three levels of risk of tumor: red flags >1%; orange flags 0.1-1%; and yellow flags <0.1% but above the background population rate of 0.01%. Clinical presentations are stratified into these 3 groups. Important secondary causes of headache where imaging is normal should not be overlooked, and normal investigation does not eliminate the need for follow-up or appropriate management of headache.	4

Headache
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20. Abu-Arafeh I, Macleod S. Serious neurological disorders in children with chronic headache. <i>Arch Dis Child</i> 2005; 90(9):937-940.	Observational-Dx	815 children and adolescents	To determine the prevalence of serious neurological disorders among children with chronic headache.	Mean duration of headache was 21.2 months (standard deviation 21.2). Neuroimaging (brain CT or MRI) was carried out on 142 (17.5%) children. The vast majority of patients had idiopathic headache (migraine, tension, or unclassified headaches). 51 children (6.3%) had other chronic neurological disorders that were unrelated to the headache. The headache in 3 children (0.37%, 95% CI: 0.08% to 1.1%) was related to active intracranial pathology which was predictable on clinical findings in 2 children but was unexpected until a later stage in one child (0.12%, 95% CI: 0.006% to 0.68%). Chronic headache in childhood is rarely due to serious intracranial pathology.	4
21. Sempere AP, Porta-Etessam J, Medrano V, et al. Neuroimaging in the evaluation of patients with non-acute headache. <i>Cephalalgia</i> 2005; 25(1):30-35.	Observational-Dx	1,876 patients	To estimate the frequency of significant intracranial lesions in patients with headache and to determine the clinical variables helpful in identifying patients with intracranial lesions.	Neuroimaging studies detected significant lesions in 22 patients (1.2%, 95% CI: 0.7, 1.8). The rate of significant intracranial abnormalities in patients with headache and normal neurological examination was 0.9% (95% CI: 0.5, 1.4). The only clinical variable associated with a higher probability of intracranial abnormalities was neurological examination. The proportion of patients with headache and intracranial lesions is relatively small, but neither neurological examination nor the features in the clinical history permit us to rule out such abnormalities.	3

Headache
EVIDENCE TABLE

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22. Becker LA, Green LA, Beaufait D, Kirk J, Froom J, Freeman WL. Use of CT scans for the investigation of headache: a report from ASPN, Part 1. <i>J Fam Pract</i> 1993; 37(2):129-134.	Observational-Dx	349 CT scans	To provide information about the reasons for ordering CT scans and the results obtained.	CT scans were ordered because the clinician believed that a tumor (49%) or a SAH (9%) might be present. 59 (17%) were ordered because of patient expectation or medicolegal concerns. Of the 293 reports reviewed, 14 indicated that a tumor, and SAH, or a subdural hematoma was present. 2/14 (14%) were false positives. 44 (15%) of the reports noted incidental findings of questionable significance. Because there are no clear guidelines for the use of CT for the investigation of headache, physicians must exercise good clinical judgment in their attempts to identify treatable disease in a cost-effective manner.	4
23. Aurora SK. Imaging chronic daily headache. <i>Curr Pain Headache Rep</i> 2003; 7(3):209-211.	Review/Other-Dx	N/A	To review literature on imaging studies performed on daily headache with emphasis on the new imaging technology.	No results stated in abstract.	4
24. Cohen AS, Goadsby PJ. Functional neuroimaging of primary headache disorders. <i>Curr Neurol Neurosci Rep</i> 2004; 4(2):105-110.	Review/Other-Dx	N/A	To review functional imaging studies in migraine, cluster headache, rarer headache syndromes, and experimental head pain.	Together with newer techniques, such as voxel-based morphometry and MR spectrometry, functional imaging continues to play a role in elucidating and targeting the neural substrates in each of the primary headache syndromes.	4
25. Medina LS, D'Souza B, Vasconcellos E. Adults and children with headache: evidence-based diagnostic evaluation. <i>Neuroimaging Clin N Am</i> 2003; 13(2):225-235.	Review/Other-Dx	N/A	To review imaging tests for headache.	The sensitivity of MRI appears to be less than CT for SAH. Contrast-enhanced MRI is the examination of choice for brain metastatic lesions <2 cm. CTA and MRA have sensitivities >85% for brain aneurysms >5 mm.	4
26. Sandrini G, Friberg L, Janig W, et al. Neurophysiological tests and neuroimaging procedures in non-acute headache: guidelines and recommendations. <i>Eur J Neurol</i> 2004; 11(4):217-224.	Review/Other-Dx	N/A	Evaluation of neurophysiological tests and imaging procedures in non-acute headache patients.	Atypical headache patterns, a history of seizures and/or focal neurological signs or symptoms, MRI may be indicated. Standard headache classification, PET or SPECT scan will generally be of no further diagnostic value. Transcranial Doppler examination is not helpful in headache diagnosis.	4
27. Silberstein SD. Chronic daily headache. <i>J Am Osteopath Assoc</i> 2005; 105(4 Suppl 2):23S-29S.	Review/Other-Dx	N/A	To review the criteria for medication-overuse headache and the subset of headaches making up chronic daily headache, as well as the epidemiologic and therapeutic aspects of these disorders.	No results stated in abstract.	4

**Headache
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28. Sandrini G, Friberg L, Coppola G, et al. Neurophysiological tests and neuroimaging procedures in non-acute headache (2nd edition). <i>Eur J Neurol</i> 2011; 18(3):373-381.	Review/Other-Dx	N/A	An update of the 2004 European Federation of Neurological Societies guidelines and recommendations for the use of neurophysiological tools and neuroimaging procedures in non-acute headache (first edition).	Although many of the examinations described in the present guidelines are of little or no value in the clinical setting, most of the tools, including thermal pain thresholds and transcranial magnetic stimulation, have considerable potential for differential diagnostic evaluation as well as for the further exploration of headache pathophysiology and the effects of pharmacological treatment.	4
29. Frishberg BM. The utility of neuroimaging in the evaluation of headache in patients with normal neurologic examinations. <i>Neurology</i> 1994; 44(7):1191-1197.	Review/Other-Dx	N/A	To review literature to determine usefulness of neuroimaging in evaluating headache patients with normal neurologic examinations.	CT or MRI may be indicated in patients with atypical headache patterns, a history of seizures or focal neurologic signs. Insufficient evidence to define the role of CT and MRI in the evaluation of patients with headaches that are inconsistent with migraine.	4
30. Mitchell CS, Osborn RE, Grosskreutz SR. Computed tomography in the headache patient: is routine evaluation really necessary? <i>Headache</i> 1993; 33(2):82-86.	Review/Other-Dx	350 patients	To determine the likelihood of a positive CT in the routine evaluation of headache patients, consecutive patients with a chief complaint of headache (some with neurological findings) were prospectively evaluated with CT.	7 (2%) of the 350 patients had CT findings that were clinically significant. An additional 25 (7%) had positive but insignificant CT findings. All of the patients with significant CT findings had an abnormal physical or neurologic exam or unusual clinical symptoms. Routine CT of the brain in headache patients with normal physical and neurologic exams and no unusual clinical symptoms has a low likelihood ratio for discovering significant intracranial disease.	4
31. Osborn RE, Alder DC, Mitchell CS. MR imaging of the brain in patients with migraine headaches. <i>AJNR Am J Neuroradiol</i> 1991; 12(3):521-524.	Review/Other-Dx	41 patients	To determine the frequency of areas of high intensity with the use of MRI in patients with migraine headaches.	Current study demonstrated parenchymal brain lesions in only 12%. Frequency of foci of high intensity seen on long TR sequences in the migraine patient is much lower than previously reported.	4

**Headache
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32. Weingarten S, Kleinman M, Elperin L, Larson EB. The effectiveness of cerebral imaging in the diagnosis of chronic headache. <i>Arch Intern Med</i> 1992; 152(12):2457-2462.	Observational-Dx	89 patients	Retrospective study with a 15-27 month follow-up period to measure the usefulness of cerebral imaging in patients with chronic isolated headache.	Review of an enriched sample of patients with malignant brain tumor and patients requiring craniotomy for other reasons (n=40) demonstrated that no patient had headache alone at the time of diagnosis (95% CI; 0%, 8%) and that only 5% (95% CI; 0%, 12%) of these patients sought medical attention for headache alone. Sampling a second enriched sample of patients who were referred from other hospitals (n=63) because of conditions requiring neurosurgical procedures demonstrated that only 6% of patients presented with chronic isolated headache alone (95% CI; 0%, 12%). Uncertainty regarding the appropriateness of imaging patients with headache was illustrated by the extreme interphysician variability of this practice.	4
33. Akpek S, Arac M, Atilla S, Onal B, Yucel C, Isik S. Cost-effectiveness of computed tomography in the evaluation of patients with headache. <i>Headache</i> 1995; 35(4):228-230.	Observational-Dx	592 patients	Retrospective review to determine the cost-effectiveness of cranial CT in patients with headache without neurological findings.	Results were divided into 3 groups. In group P0, the authors included patients with normal cranial CT findings. In group P1, patients showed some minor pathologies like ischemic or atrophic changes. These findings neither explained the reason for headache nor changed the clinical or therapeutic approach. The third group (P2) was to include patients with gross intracranial pathology like space-occupying lesions or bleeding. 546/592 patients were in the P0 group (92%), and the remaining 46 patients were in the P1 group (8%). No patient was found to have serious intracranial pathology detected by CT.	4

Headache
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34. Cull RE. Investigation of late-onset migraine. <i>Scott Med J</i> 1995; 40(2):50-52.	Observational-Dx	69 patients	Prospective study to determine whether routine examination of patients with late-onset migraine is of value.	Migraine with aura was reported in 86% of patients. 46% of the females had active menopausal symptoms. No significant haematological or serological abnormalities were detected. CT or MRI brain imaging was normal in 93% of cases; 4 patients had evidence of cerebral infarction. No cerebral tumor or vascular malformation was found. Three patients had evidence of mild-moderate carotid atheroma on US scanning. Routine detailed investigation of late-onset migraine is unlikely to be of value unless the history is atypical or abnormalities are present on clinical examination.	4
35. Demaerel P, Boelaert I, Wilms G, Baert AL. The role of cranial computed tomography in the diagnostic work-up of headache. <i>Headache</i> 1996; 36(6):347-348.	Observational-Dx	363 patients	To assess the value of cranial CT in the diagnosis of headache.	Normal examinations were 88.4%, but the authors advocate the routine use of a cranial CT in every patient with chronic headache. The cost of the examination can significantly be reduced by performing an unenhanced scan only. An additional contrast-enhanced scan should be obtained if a suspicious lesion is seen. Brain MRI is not indicated except in the preoperative workup of a lesion visualized on CT.	4

Headache
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36. Dumas MD, Pexman JH, Kreeft JH. Computed tomography evaluation of patients with chronic headache. <i>CMAJ</i> 1994; 151(10):1447-1452.	Observational-Dx	373 patients underwent 402 scans	To determine whether the rate of detecting a tumor, AVM or aneurysm with the use of enhanced or unenhanced CT is significant in patients with chronic headache and to calculate the cost.	Of the 402 CT scans 14 (95% CI: 7 to 21) revealed minor findings that did not alter patient management: infarct (9 scans), cerebral atrophy (2), cavum vergae (1), hyperostosis frontalis interna (1) and communicating hydrocephalus (1). Four scans (95% CI: 0 to 8) showed significant lesions: osteoma (2), low-grade glioma (1) and aneurysm (1); only the aneurysm was treated. There were no cases of AVM. An unenhanced scan cost \$82.63 and an enhanced scan \$204.05. The cost per significant finding was over \$18,000. In all, it cost \$74,243 to find one treatable vascular lesion. The detection rate of CT scanning in patients with chronic headache is similar to that expected in the general population, provided the neurologic findings are normal. The cost of detecting intracranial lesions in this patient population is high.	4
37. Maytal J, Bienkowski RS, Patel M, Eviatar L. The value of brain imaging in children with headaches. <i>Pediatrics</i> 1995; 96(3 Pt 1):413-416.	Observational-Dx	78 brain imaging studies	Retrospective chart review to determine the value of performing CT on MRI studies in children with chronic headaches.	Cerebral abnormalities were found on brain imaging in 4 patients, but none indicated the presence of a treatable disease and all were deemed unrelated to the presenting complaint. Findings of no relevant abnormalities in a series of 78 brain imaging studies indicate that the maximal rate at which such abnormalities might appear in this population is 3.8%. Results indicate that brain imaging studies have very limited value in evaluating headaches in pediatric patients without clinical evidence of an underlying structural lesion.	4
38. McAbee GN, Siegel SE, Kadakia S, Cantos E. Value of MRI in pediatric migraine. <i>Headache</i> 1993; 33(3):143-144.	Review/Other-Dx	24 pediatric migraineurs	Prospective study to determine incidence of MRI abnormalities in children with migraine.	None had white matter findings or brain abnormalities. Five had mucoperiosteal thickening of the paranasal sinuses, which were unrelated to the patients' clinical course. MRI white matter findings are probably not a common occurrence in pediatric migraineurs. In addition, MRI sinus findings are not necessarily related to a child's headache complaints.	4

**Headache
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39. Sotaniemi KA, Rantala M, Pyhtinen J, Myllyla VV. Clinical and CT correlates in the diagnosis of intracranial tumours. <i>J Neurol Neurosurg Psychiatry</i> 1991; 54(7):645-647.	Observational-Dx	1,191 patients	Prospective study to examine the correlation between clinical and CT findings in cerebral tumors.	CT revealed a mass lesion in 51 cases (4.3%): 32 neoplasms, 5 haematoma and 1 abscess. The diagnostic specificity of CT for neoplastic tumors was 86% (32/37). The clinical suspicion of a cerebral neoplasm was correct in 25 cases (78%) and the clinical localisatory hypothesis was correct in 20 cases (63%) of the neoplasms. A cerebral tumor was found in 5% (11/226) of patients investigated for their first seizure and in 1% (2/207) investigated for headache without clinical signs.	3
40. Reinus WR, Erickson KK, Wippold FJ, 2nd. Unenhanced emergency cranial CT: optimizing patient selection with univariate and multivariate analyses. <i>Radiology</i> 1993; 186(3):763-768.	Observational-Dx	1,074 patients	To review charts of patients who underwent cranial CT for predictors of a CT abnormality.	26 clinical variables and the results of neurologic examination were compared with cranial CT findings. Patients with focal neurologic deficit, unresponsiveness, and hypertension had an increased risk of a CT abnormality. Blurred vision, trauma, loss of consciousness, headache, and dizziness were each associated with a lower risk of a CT abnormality. Multivariate analysis showed that only focal neurologic deficit and unresponsiveness effectively helped predict a CT abnormality. In patients with negative neurologic findings, only intoxication and amnesia were associated with greater than 10% positive scans and an increased risk for a CT abnormality. The data indicate that positive neurologic findings coupled with intoxication and amnesia would have helped detect 90.7% of the positive scans and provide an effective initial approximation strategy for selecting patients to undergo CT. Although 15 patients with positive scans (1.4%) would have been missed, this strategy would have yielded a NPV of 97.3% and eliminated 53.9% of the CT scans obtained.	4

Headache
EVIDENCE TABLE

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41. Kerber KA, Meurer WJ, West BT, Fendrick AM. Dizziness presentations in U.S. emergency departments, 1995-2004. <i>Acad Emerg Med</i> 2008; 15(8):744-750.	Observational-Dx	7,160 sampled visits for vertigo-dizziness identified over 10-year period	To describe presentation characteristics and health care utilization information pertaining to dizziness presentations in U.S. EDs from 1995 through 2004.	Vertigo-dizziness presentations accounted for 2.5% (95% CI: = 2.4% to 2.6%) of all ED presentations during this 10-year period. From 1995 to 2004, the rate of visits for vertigo-dizziness increased by 37% and demonstrated a significant linear trend (P<0.001). Even after adjusting for age (and other covariates), every increase in year was associated with increased odds of a vertigo-dizziness visit. At each visit, a median of 3.6 diagnostic or screening tests (95% CI: = 3.2 to 4.1) were performed. Utilization of many tests increased over time (P<0.01). The utilization of CT/MRI increased 169% from 1995 to 2004, which was more than any other test. The rate of central nervous system diagnoses (e.g., cerebrovascular disease or brain tumor) did not increase over time. In terms of number of visits and important utilization measures, the impact of dizziness presentations on EDs is substantial and increasing. CT/MRI utilization rates have increased more than any other test.	4
42. Porter KR, McCarthy BJ, Freels S, Kim Y, Davis FG. Prevalence estimates for primary brain tumors in the United States by age, gender, behavior, and histology. <i>Neuro Oncol</i> 2010; 12(6):520-527.	Observational-Dx	2004 (n=612,770) and 2010 (n=688,096)	To provide an estimate of the prevalence of disease in the United States, updating an earlier prevalence study.	The overall incidence rate for primary brain tumors was 18.1 per 100,000 person-years with 2-, 5-, 10-, and 20-year observed survival rates of 62%, 54%, 45%, and 30%, respectively. On the basis of the sum of nonmalignant and averaged malignant estimates, the overall prevalence rate of individuals with a brain tumor was estimated to be 209.0 per 100,000 in 2004 and 221.8 per 100,000 in 2010. The female prevalence rate (264.8 per 100,000) was higher than that in males (158.7 per 100,000). The averaged prevalence rate for malignant tumors (42.5 per 100,000) was lower than the prevalence for nonmalignant tumors (166.5 per 100,000).	4
43. Singer RJ, Ogilvy CS, Rordorf G. Etiology, clinical manifestations, and diagnosis of aneurysmal subarachnoid hemorrhage. In: Biller J, ed. <i>UpToDate</i> . Waltham, MA; 2012.	Review/Other-Dx	N/A	A review on the epidemiology, etiology, clinical manifestations, and diagnosis of aneurysmal SAH.	No results stated in abstract.	4

Headache
EVIDENCE TABLE

Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Study Quality
44. Al-Shahi R, Warlow C. A systematic review of the frequency and prognosis of arteriovenous malformations of the brain in adults. <i>Brain</i> 2001; 124(Pt 10):1900-1926.	Review/Other-Dx	N/A	To conduct a systematic review of the frequency and prognosis of AVMs of the brain in adults.	The incidence of AVMs is approximately 1 per 100,000 per year in unselected populations, and the point prevalence in adults is approximately 18 per 100,000. AVMs account for between 1% and 2% of all strokes, 3% of strokes in young adults, 9% of SAHs and, of all primary intracerebral hemorrhages; they are responsible for 4% overall, but for as much as one-third in young adults. AVMs are far less common causes of first presentations with unprovoked seizures (1%), and of people presenting with headaches in the absence of neurological signs (0.3%).	4
45. Friedlander RM. Clinical practice. Arteriovenous malformations of the brain. <i>N Engl J Med</i> 2007; 356(26):2704-2712.	Review/Other-Dx	N/A	No abstract available.	No abstract available.	4
46. Forsyth PA, Posner JB. Headaches in patients with brain tumors: a study of 111 patients. <i>Neurology</i> 1993; 43(9):1678-1683.	Observational-Dx	111 patients	To characterize brain tumor headache in patients with primary or metastatic brain tumors identified by CT or MRI.	Headaches were present in 48%, equally for primary and metastatic brain tumors. Headaches were similar to tension-type in 77%, migraine-type in 9%, and other types in 14%. The typical headache was bifrontal but worse ipsilaterally, and was the worst symptom in only 45% of patients.	4
47. Purdy RA, Kirby S. Headaches and brain tumors. <i>Neurol Clin</i> 2004; 22(1):39-53.	Review/Other-Dx	N/A	To review headaches and brain tumors.	Imaging of headache patients for tumors, if they have primary headache disorders, such as migraine and typical cluster, generally is not cost effective but is necessary if there are any atypical features.	4
48. Suwanwela N, Phanthumchinda K, Kaoropthum S. Headache in brain tumor: a cross-sectional study. <i>Headache</i> 1994; 34(7):435-438.	Observational-Dx	171 patients	To determine the prevalence and clinical profiles of headache in patients with brain tumor.	The prevalence of headache was 71%. The duration of headache ranged from 3 days to 10 years with an average of 15.7 months. Most prominent headache profiles in this series were intermittent, nocturnal and early morning headache as well as headache upon arising. Most of the patients had mild to moderately severe headache. Headache is more common with tumors below the tentorium cerebelli. It is more prevalent in primary and intracerebral tumor than in metastatic and extracerebral tumor. Headache has lateralizing value, especially in patients with supratentorial lesions who have no obvious increased intracranial pressure.	4

**Headache
EVIDENCE TABLE**

Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Study Quality
49. The epidemiology of headache among children with brain tumor. Headache in children with brain tumors. The Childhood Brain Tumor Consortium. <i>J Neurooncol</i> 1991; 10(1):31-46.	Observational-Dx	3,291 patients	To determine the frequency of headache in the presentation of brain tumors in children.	Overall, 62% of the children with brain tumors experienced chronic or frequent headaches prior to their first hospitalization: 58% of children with supratentorial tumors and 70% of children with infratentorial tumors. No specific symptoms or neurologic signs were associated with headache in children with infratentorial tumors. Supratentorial craniopharyngioma, ependymoma, and protoplasmic astrocytoma were associated with significantly high rates of headache as was infratentorial pilocytic astrocytoma.	4
50. Ansell P, Johnston T, Simpson J, Crouch S, Roman E, Picton S. Brain tumor signs and symptoms: analysis of primary health care records from the UKCCS. <i>Pediatrics</i> 2010; 125(1):112-119.	Observational-Dx	195 children newly diagnosed with brain tumors and 285 controls	To compare the frequency of brain tumor signs and symptoms in children with and without brain tumors.	On average, cases consulted more often than controls between birth and diagnosis/pseudodiagnosis with brain tumor signs and symptoms. Their consultation rate with 1 suggestive symptom escalated in the 2 years before diagnosis. Symptom prevalence was higher among cases than controls, a relative difference of 3.29 times as many consultations with 1 suggestive symptom (95% CI: 2.82-3.83) and 7.01 as many with more than 1 (95% CI: 5.38-9.13). In each 6-month period in the 4 years before diagnosis, cases had at least twice as many consultations with 1 suggestive symptom (20.81 times as many in the 6 months before diagnosis [95% CI: 14.29-30.30]) and 2-3 times more records of suggestive symptoms (28.35 times more in the 6 months before diagnosis [95% CI: 19.05-42.19]). Symptoms rarely or not observed among control children included head tilt, odd head movements, odd posture, back or neck stiffness, and unsteadiness without obvious cause. Key to identifying the 1 child among many who merits prompt investigation is recognition of unusual symptoms, or specific symptom patterns.	4

Headache
EVIDENCE TABLE

Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Study Quality
51. Ishimaru H, Ochi M, Morikawa M, et al. Accuracy of pre- and postcontrast 3D time-of-flight MR angiography in patients with acute ischemic stroke: correlation with catheter angiography. <i>AJNR Am J Neuroradiol</i> 2007; 28(5):923-926.	Review/Other-Dx	13 patients	To correlate pre- and postcontrast 3D TOF MRA with the results of conventional angiography during endovascular reperfusion therapy and to determine the accuracy of postcontrast 3D TOF MRA.	In 2 of 5 patients with arterial stenosis and 6 of 8 patients with complete occlusion, MRA signal intensity proximal to each lesion was absent, indicating a proximal pseudo-occlusion on precontrast MRA. Postcontrast MRA demonstrated an arterial signal intensity proximal to the stenotic or occlusive lesions in all 13 patients. Arterial signal intensity distal to the occlusion was identified on postcontrast MRA in 7 of 8 patients having complete occlusion, and the extent of occlusion on postcontrast MRA was similar to results of conventional angiography.	4
52. Kinoshita T, Ogawa T, Kado H, Sasaki N, Okudera T. CT angiography in the evaluation of intracranial occlusive disease with collateral circulation: comparison with MR angiography. <i>Clin Imaging</i> 2005; 29(5):303-306.	Review/Other-Dx	10 patients	To determine whether 3D CTA is superior to MRA in the evaluation of collateral circulation in patients with intracranial arterial occlusive disease.	Collateral vessels were well visualized by CTA, but not by MRA, while conventional angiography revealed leptomeningeal collateral vessels that were filled in a retrograde fashion. CTA is superior to MRA for evaluating collateral vessels.	4
53. Linn FH, Wijdicks EF, van der Graaf Y, Weerdesteyn-van Vliet FA, Bartelds AI, van Gijn J. Prospective study of sentinel headache in aneurysmal subarachnoid haemorrhage. <i>Lancet</i> 1994; 344(8922):590-593.	Review/Other-Dx	148	To study the characteristics of sentinel headache preceding SAH.	SAH was the cause of sudden, severe headache in 37 patients (25%). Other serious neurological conditions [determine] were diagnosed in 18. In the remaining 93, no underlying cause of headache was found; follow-up over 1 year showed no subsequent SAH or sudden death. Acute, severe headache in general practice indicated a serious neurological disorder in 37% (95% CI: 29%-45%), and SAH in 25% (18%-32%). 12% (5%-18%) of those with headache as the only symptom.	4
54. Lledo A, Calandre L, Martinez-Menendez B, Perez-Sempere A, Portera-Sanchez A. Acute headache of recent onset and subarachnoid hemorrhage: a prospective study. <i>Headache</i> 1994; 34(3):172-174.	Review/Other-Dx	27	Prospective study to determine the frequency of SAH in patients coming to the ED with acute severe headache.	CT disclosed subarachnoid bleeding in 4 patients and spinal tap revealed SAH in 5 patients with normal CT scan, for a total of 33% with SAH.	4
55. van der Wee N, Rinkel GJ, Hasan D, van Gijn J. Detection of subarachnoid haemorrhage on early CT: is lumbar puncture still needed after a negative scan? <i>J Neurol Neurosurg Psychiatry</i> 1995; 58(3):357-359.	Observational-Dx	175	To determine incidence of SAH, patients with sudden headache and a normal neurological examination who had first CT within 12 hours after the onset of headache were investigated.	CT showed subarachnoid blood in 117 patients, and was normal in 58. 2/58 had SAH diagnosed by lumbar puncture.	3

Headache
EVIDENCE TABLE

Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Study Quality
56. Vale FL, Bradley EL, Fisher WS, 3rd. The relationship of subarachnoid hemorrhage and the need for postoperative shunting. <i>J Neurosurg</i> 1997; 86(3):462-466.	Observational-Dx	108	To determine the incidence and effect of chronic hydrocephalus by looking at whether the need for ventriculoperitoneal shunting can be predicted by initial Hunt and Hess grade or Fisher CT score.	All SAH patients were managed in a similar fashion with induced hypervolemia, relative hemodilution, and hypertension complemented by a course of calcium channel blockers. The majority of patients underwent perioperative extracranial ventricular drainage to allow intraoperative brain relaxation and to assist intracranial pressure management. The overall mortality rate of the study group was 17%. Of the surviving patients, 20% underwent ventriculoperitoneal shunt placement secondary to chronic hydrocephalus. There were no statistically significant relationships between chronic hydrocephalus and patient age or gender, aneurysm type and size, or use of a perioperative drain. There was a high clinical correlation between chronic hydrocephalus and admission Hunt and Hess grades and Fisher grades ($P < 0.05$). All of the patients who survived a second bleeding episode and almost 46% of the patients who presented with intraventricular hemorrhage required placement of a ventriculoperitoneal shunt.	4
57. Suarez JI, Tarr RW, Selman WR. Aneurysmal subarachnoid hemorrhage. <i>N Engl J Med</i> 2006; 354(4):387-396.	Review/Other-Dx	N/A	To review aneurysmal SAH.	No results stated in abstract.	4
58. Jayaraman MV, Mayo-Smith WW, Tung GA, et al. Detection of intracranial aneurysms: multi-detector row CT angiography compared with DSA. <i>Radiology</i> 2004; 230(2):510-518.	Observational-Dx	35 total patients	To prospectively compare the effectiveness of multi-detector row CTA with that of conventional intra-arterial DSA used to detect intracranial aneurysms in patients with nontraumatic acute SAH.	A total of 26 aneurysms were detected at DSA in 21 patients, and no aneurysms were detected in 14 patients. Sensitivity and specificity for CTA were, respectively, 90% and 93% for reader 1 and 81% and 93% for reader 2. The mean diameter of aneurysms detected on CTA images was 4.4 mm, and the smallest aneurysm detected was 2.2 mm in diameter. Aneurysms that were missed at initial interpretation of CTA images were identified at retrospective reading.	1

**Headache
EVIDENCE TABLE**

Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Study Quality
59. Silbert PL, Mokri B, Schievink WI. Headache and neck pain in spontaneous internal carotid and vertebral artery dissections. <i>Neurology</i> 1995; 45(8):1517-1522.	Review/Other-Dx	161	To determine the characteristics of headaches in patients with spontaneous dissections of the ICA (n=135) or the vertebral artery (n=26).	A history of migraine was present in 18% of the ICA group and in 23% of the vertebral artery group. Headache was reported by 68% of the patients with ICA and by 69% of those with vertebral artery, and, when present, it was the initial manifestation in 47% of those with ICA and in 33% of those with vertebral artery.	4
60. Biousse V, D'Anglejan-Chatillon J, Massiou H, Bousser MG. Head pain in non-traumatic carotid artery dissection: a series of 65 patients. <i>Cephalalgia</i> 1994; 14(1):33-36.	Review/Other-Dx	65	To assess the prevalence and characteristics of cephalic pain in ICA dissection, and to compare clinical and angiographic features of patients with painful and non-painful dissections.	48 patients (74%) complained of a cephalic pain which was inaugural in 38 (58.5%). Signs of cerebral or retinal ischemia were observed in 79% of patients, often delayed and occurring up to 29 days after the onset of pain. A painful Horner's syndrome was present in 31% of patients, and was the only manifestation of dissection in 16%.	4
61. Reede DL, Garcon E, Smoker WR, Kardon R. Horner's syndrome: clinical and radiographic evaluation. <i>Neuroimaging Clin N Am</i> 2008; 18(2):369-385, xi.	Review/Other-Dx	N/A	To review the anatomy of the oculosympathetic pathway and clinical findings associated with lesions located at various positions along this pathway.	The clinical symptoms of Horner's syndrome may cause little if any functional impairment in most patients. However, since benign and malignant processes are associated with Horner's syndrome, a thorough clinical evaluation is required. Once a lesion is localized clinically within the oculosympathetic pathway by physical examination and pharmacological testing, the radiologic examination can be properly tailored.	4
62. Provenzale JM, Sarikaya B. Comparison of test performance characteristics of MRI, MR angiography, and CT angiography in the diagnosis of carotid and vertebral artery dissection: a review of the medical literature. <i>AJR</i> 2009; 193(4):1167-1174.	Review/Other-Dx	N/A	To review medical literature on use of MRI, MRA, and CTA to determine, based on test performance characteristics such as sensitivity, specificity, PPV, and NPV, whether evidence could be found to support routine use of one imaging technique over the other for assessment of suspected dissection of the carotid or vertebral arteries.	Test characteristics for MR techniques such as MRI and MRA were relatively similar to those for CTA in diagnosis of carotid and vertebral artery dissection.	4

**Headache
EVIDENCE TABLE**

Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Study Quality
63. Nakiri GS, Santos AC, Abud TG, Aragon DC, Colli BO, Abud DG. A comparison between magnetic resonance angiography at 3 Teslas (time-of-flight and contrast-enhanced) and flat-panel digital subtraction angiography in the assessment of embolized brain aneurysms. <i>Clinics (Sao Paulo)</i> 2011; 66(4):641-648.	Observational-Dx	43 aneurysms in 30 patients	To compare the TOF and contrast-enhanced-MRA techniques in a 3T MR unit with DSA with the latest flat-panel technology and 3D reconstruction in the evaluation of embolized cerebral aneurysms.	Inter-observer agreement was excellent for both methods (K = 0.93; 95% CI: 0.84-1). Inter-technical agreement was almost perfect between TOF-MRA and DSA (K = 0.98; 95% CI: 0.93-1) and between TOF-MRA and contrast-enhanced-MRA (K = 0.98; 95% CI: 0.93-1). Disagreement occurred in only one case (2.3%), which was classified as Class I by TOF-MRA and Class II by DSA. The agreement between contrast-enhanced-MRA and DSA was perfect (K = 1; 95% CI: 1-1). In 3 patients, in-stent stenosis was identified by MRA but not confirmed by DSA.	2
64. Favier I, van Vliet JA, Roon KI, et al. Trigeminal autonomic cephalgias due to structural lesions: a review of 31 cases. <i>Arch Neurol</i> 2007; 64(1):25-31.	Review/Other-Dx	31 Cases	To review the literature and 4 new cases of a trigeminal autonomic cephalgias or trigeminal autonomic cephalgias-like syndrome associated with a structural lesion in which symptoms resolved after treatment of the lesion.	Even typical trigeminal autonomic cephalgias can be caused by an underlying lesion. Clinical warning signs and symptoms are relatively rare.	4

**Headache
EVIDENCE TABLE**

Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Study Quality
65. Levy MJ, Matharu MS, Meeran K, Powell M, Goadsby PJ. The clinical characteristics of headache in patients with pituitary tumours. <i>Brain</i> 2005; 128(Pt 8):1921-1930.	Review/Other-Dx	84 patients	To describe prospectively the phenotypic characteristics of pituitary tumor related to headache in a large series of patients and to correlate the headache presentations with the tumor biology.	The patients presented with chronic (46%) and episodic (30%) migraine, short-lasting unilateral neuralgiform headache attacks with conjunctival injection and tearing (short-lasting unilateral neuralgiform headache attacks with conjunctival injection and tearing; 5%), cluster headache (4%), hemicrania continua (1%) and primary stabbing headache (27%). It was not possible to classify the headache according to International Headache Society diagnostic criteria in six cases (7%). Cavernous sinus invasion was present in the minority of presentations (21%), but was present in 2/3 patients with cluster headache. short-lasting unilateral neuralgiform headache attacks with conjunctival injection and tearing-like headache was only seen in patients with acromegaly and prolactinoma. Hypophysectomy improved headache in 49% and exacerbated headache in 15% of cases. Somatostatin analogues improved acromegaly-associated headache in 64% of cases, although rebound headache was described in three patients. Dopamine agonists improved headache in 25% and exacerbated headache in 21% of cases.	4
66. Head Imaging Guidelines. http://www.tmhp.com/RadiologyClinicalDecisionSupport/2011/HEAD%20IMAGING%20GUIDELINES%202011.pdf . Accessed 28 January 2013.	Review/Other-Dx	N/A	No abstract available.	No abstract available.	4

**Headache
EVIDENCE TABLE**

Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Study Quality
67. Majoie CB, Hulsmans FJ, Verbeeten B, Jr., et al. Trigeminal neuralgia: comparison of two MR imaging techniques in the demonstration of neurovascular contact. <i>Radiology</i> 1997; 204(2):455-460.	Review/Other-Dx	N/A	Systematic review to answer the following questions: 1) In patients with TN, how often does routine neuroimaging (CT, MRI) identify a cause? 2) Which features identify patients at increased risk for symptomatic TN (symptomatic TN; i.e., a structural cause such as a tumor)? 3) Does high-resolution MRI accurately identify patients with neurovascular compression? 4) Which drugs effectively treat classic and symptomatic TN? 5) When should surgery be offered? 6) Which surgical technique gives the longest pain-free period with the fewest complications and good quality of life?	In patients with TN, routine head imaging identifies structural causes in up to 15% of patients and may be considered useful (Level C). Trigeminal sensory deficits, bilateral involvement of the trigeminal nerve, and abnormal trigeminal reflexes are associated with an increased risk of symptomatic TN and should be considered useful in distinguishing symptomatic TN from classic TN (Level B). There is insufficient evidence to support or refute the usefulness of MRI to identify neurovascular compression of the trigeminal nerve (Level U). Carbamazepine (Level A) or oxcarbazepine (Level B) should be offered for pain control while baclofen and lamotrigine (Level C) may be considered useful. For patients with TN refractory to medical therapy, Gasserian ganglion percutaneous techniques, gamma knife, and microvascular decompression may be considered (Level C). The role of surgery vs pharmacotherapy in the management of TN in patients with MS remains uncertain.	4
68. Gronseth G, Cruccu G, Alksne J, et al. Practice parameter: the diagnostic evaluation and treatment of trigeminal neuralgia (an evidence-based review): report of the Quality Standards Subcommittee of the American Academy of Neurology and the European Federation of Neurological Societies. <i>Neurology</i> 2008; 71(15):1183-1190.	Review/Other-Dx	26 patients	To evaluate a sample of patients with persistent facial pain unresponsive to prior treatments.	Patients were classified into 3 groups according to their presenting symptoms: a) Group I, 8 patients (30.7%) with severe, diffuse pain at the face, teeth or head; b) Group II, 8 patients (30.7%) with chronic non-myofascial pain and; c) Group III, 10 patients with chronic myofascial pain (38.4%). We find 11 different diagnoses among the 26 patients: pulpitis (7), leukemia (1), oropharyngeal tumor (1), atypical odontalgia (1), Eagle's syndrome (1), TN (4), continuous neuralgia (1), temporomandibular disorders (9), fibromyalgia (2), tension-type headache (1), conversion hysteria (2). After the treatment program all patients had a 6-month follow-up period with pain relief, except the patient with tumor.	4

**Headache
EVIDENCE TABLE**

Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Study Quality
69. Siqueira JT, Lin HC, Nasri C, et al. Clinical study of patients with persistent orofacial pain. <i>Arq Neuropsiquiatr</i> 2004; 62(4):988-996.	Review/Other-Dx	100 patients	To assess patients with suspected temporomandibular joint arthropathy in whom 64 also complained of headache and/or facial pain using high field surface coil MRI.	Each patient complained of pain and/or tenderness localized to the immediate vicinity of at least one temporomandibular joint. Pathologic joint effusion was demonstrated by MR in 88 of the painful joints studied. Significant meniscus displacement, with or without meniscus deformity and alteration of intrinsic signal intensity was present in 94 of the 100 painful joints examined. Fascial inflammation and atrophy of the ipsilateral muscles of mastication were observed occasionally with painful joints. There were no mechanical temporomandibular joint symptoms, such as joint clicking, crepitus or locking in 14 internally deranged and painful joints, 12 of which exhibited joint effusion and local inflammation. At least 80 patients described occlusal changes within 12 months of imaging. 28 of the pathologic joints in the series underwent subsequent meniscectomy, including routine histologic evaluation of surgical material.	4
70. Cheng TM, Cascino TL, Onofrio BM. Comprehensive study of diagnosis and treatment of trigeminal neuralgia secondary to tumors. <i>Neurology</i> 1993; 43(11):2298-2302.	Review/Other-Dx	58 patients	To examine patients presenting with TN, characterize the association with specific tumors, evaluate the course of diagnosis and treatment to understand the disease process and determine optimal management.	Meningiomas and posterior fossa tumors were the most common. Neurologic deficits developed on follow-up evaluation in 47% of the patients, often precipitating further study and eventual diagnosis of the tumor. Delay in tumor diagnosis averaged 6.3 years. CT with contrast was the most frequently used initial diagnostic radiographic technique, detecting a tumor in 40/43 examinations. MRI was subsequently used to confirm and better delineate the tumor in 5/5 cases. Carbamazepine was the most effective drug for relieving TN, but relief was usually temporary. Of the surgical treatment options, total removal of the tumor was the most effective in completely relieving tic pain. In patients at high surgical risk, however, temporarily or permanently blocking afferent impulses with radiofrequency ablation, glycerol rhizotomy, or alcohol blocks was a good alternative to craniotomy.	4

**Headache
EVIDENCE TABLE**

Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Study Quality
71. Bone I, Hadley DM. Syndromes of the orbital fissure, cavernous sinus, cerebello-pontine angle, and skull base. <i>J Neurol Neurosurg Psychiatry</i> 2005; 76 Suppl 3:iii29-iii38.	Review/Other-Dx	N/A	To review the clinical presentation, neuroradiological approach, and the application of helpful ancillary investigations in the diagnosis of a range of cranial nerve syndromes.	No results stated in abstract.	4
72. Kari E, DelGaudio JM. Treatment of sinus headache as migraine: the diagnostic utility of triptans. <i>Laryngoscope</i> 2008; 118(12):2235-2239.	Experimental-Dx	54	Prospective clinical trial to determine the response rate to triptans in alleviating "sinus headache" in patients with endoscopy- and CT-negative sinus examinations.	54 patients were enrolled. 38 (69%) completed follow-up, 63% were women. The mean age was 41 years (23-70). 31 patients (82%) had significant reduction of headache pain with triptan use. 35 patients (92%) had a significant reduction in headache pain in response to migraine-directed therapy. 17 patients (31%) withdrew or failed to follow-up, often reluctant to accept a diagnosis of migraine.	4
73. Jordan YJ, Lightfoote JB, Jordan JE. Computed tomography imaging in the management of headache in the emergency department: cost efficacy and policy implications. <i>J Natl Med Assoc</i> 2009; 101(4):331-335.	Review/Other-Dx	882	To evaluate the economic impact and diagnostic utility of CT in the management of ED patients presenting with headache and nonfocal physical examinations.	882 (16%) met the above criteria. 281 patients demonstrated positive CT findings (31.8%), but only 9 (1.02%) demonstrated clinically significant results (requiring a change in management). Most positive studies were incidental, including old infarcts, chronic ischemic changes, encephalomalacia, and sinusitis. The average cost of the head CT and ED visit was \$764 (2006 dollars). This was approximately 3 times the cost of a routine outpatient visit (plus CT) for headache (\$253). The incremental cost per clinically significant case detected in the ED was \$50,078. The calculated expected maximum number of clinically significant positive cases was almost 50% lower than what was actually detected.	4
74. Anzai Y, Weymuller EA, Jr., Yueh B, Maronian N, Jarvik JG. The impact of sinus computed tomography on treatment decisions for chronic sinusitis. <i>Arch Otolaryngol Head Neck Surg</i> 2004; 130(4):423-428.	Observational-Dx	3 otolaryngologists, 27 patients	To determine the impact of sinus CT on treatment decisions by otolaryngologists and to explore the factors leading to choice of surgical treatment for patients suspected of having chronic sinusitis.	The dichotomous treatment decisions were changed in one third of patients (9/27) after the sinus CT scans were reviewed. The agreement of treatment decisions among the 3 surgeons was markedly improved after they reviewed sinus CT scans. The factors favorably influencing surgical treatment were obstruction of the ostiomeatal complex on CT and concordance of CT abnormality with a patient's symptoms. Lund-Mackay stage, symptoms, and corticosteroid or antibiotic use were not significant predictors.	3

* See Last Page for Key

**Headache
EVIDENCE TABLE**

Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Study Quality
75. Huang HH, Lee TJ, Huang CC, Chang PH, Huang SF. Non-sinusitis-related rhinogenous headache: a ten-year experience. <i>Am J Otolaryngol</i> 2008; 29(5):326-332.	Observational-Dx	71 patients	To investigate the role of anatomical abnormalities in non-sinusitis-related rhinogenous headache and to evaluate response to surgery.	Multiple sinonasal anomalies were noted by endoscopy and sinus computed tomographic scans in the 66 patients in the study. These included nasal septum deviation in 46 (69.7%), concha bullosum in 33 (48.5%), and Haller cell in 11 (16.7%). 30 of the patients with nasal septum deviation needed surgical intervention. 54 (81.8%) of the 66 patients in the study showed significant improvement after surgery and did not require further medical therapy.	4
76. Lucente FE, Sobol SH. <i>Essentials of otolaryngology</i> . 3rd ed. New York: Raven Press; 1993.	Review/Other-Dx	N/A	Book.	N/A	4
77. Schellhas KP, Wilkes CH, Baker CC. Facial pain, headache, and temporomandibular joint inflammation. <i>Headache</i> 1989; 29(4):229-232.	Observational-Dx	13 patients with unilateral TN; 50 control subjects	To compare two MRI techniques for demonstration of vascular contact with the trigeminal nerve.	Vascular contact with the trigeminal nerve at the root entry zone was seen on fast inflow with steady-state precession images in 10/13 (77%) symptomatic nerves and in 8/113 (7%) asymptomatic nerves (P<.001). Magnetization-prepared rapid acquisition gradient-echo and fast inflow with steady-state precession images demonstrated arterial contacts equally well. Magnetization-prepared rapid acquisition gradient-echo images demonstrated one additional venous contact at the root entry zone in a patient with ipsilateral TN. Interobserver agreement was good for both fast inflow with steady-state precession (kappa = 0.69) and magnetization-prepared rapid acquisition gradient-echo (kappa = 0.78) images. The presence of vascular contact at the root entry zone, seen on preoperative MRI, was confirmed in all 6 patients who underwent surgery.	2

Headache
EVIDENCE TABLE

Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Study Quality
78. Caselli RJ, Hunder GG, Whisnant JP. Neurologic disease in biopsy-proven giant cell (temporal) arteritis. <i>Neurology</i> 1988; 38(3):352-359.	Review/Other-Dx	166	To study neurologic findings in patients with biopsy-proven GCA.	Neurologic problems occurred in 51 patients (31%): neuropathies (23), TIA/strokes (12), neuro-otologic syndromes (11), tremor (6), neuropsychiatric syndromes (5), tongue numbness (3), and myelopathy (1). Neuro-ophthalmologic problems occurred in 35 patients (21%): amaurosis fugax (17), permanent vision loss (14), scintillating scotoma (8), and diplopia (3). Abnormalities in large arteries in 52 patients (31%) included bruits and diminished pulses. The carotid artery was involved in 31 patients (bilateral in 58%). Overall, 35% of patients with carotid disease had TIA/stroke, amaurosis fugax, or permanent vision loss.	4
79. Husein AM, Haq N. Cerebral arteritis with unusual distribution. <i>Clin Radiol</i> 1990; 41(5):353-354.	Review/Other-Dx	N/A	Case report of the diagnosis of GCA.	Important to recognize GCA, which can be effectively controlled with steroids.	4
80. Wilkinson IM, Russell RW. Arteries of the head and neck in giant cell arteritis. A pathological study to show the pattern of arterial involvement. <i>Arch Neurol</i> 1972; 27(5):378-391.	Review/Other-Dx	12	A pathological study on patients with GCA to show the pattern of arterial involvement.	Observed relative frequency of some clinical phenomena in 12 cases are: Sudden monocular blindness in 7 cases. Sudden total occipital blindness in 2 cases. Clinical indications of brain stem ischemia in 5 cases, taking the form of the lateral medullary syndrome in 3 cases. Clinical features of severe unilateral cerebral hemisphere ischemia in 2 cases.	4
81. Hunder GG, Bloch DA, Michel BA, et al. The American College of Rheumatology 1990 criteria for the classification of giant cell arteritis. <i>Arthritis Rheum</i> 1990; 33(8):1122-1128.	Review/Other-Dx	214 patients with the disease; 593 patients with other forms of vasculitis	To determine the criteria for the classification of GCA.	The presence of 3 or more of these 5 criteria was associated with a sensitivity of 93.5% and a specificity of 91.2%. A classification tree was also constructed using 6 criteria. These criteria were the same as for the traditional format, except that elevated erythrocyte sedimentation rate was excluded, and 2 other variables were included: scalp tenderness and claudication of the jaw or tongue or on deglutition. The classification tree was associated with a sensitivity of 95.3% and specificity of 90.7%.	4

Headache
EVIDENCE TABLE

Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Study Quality
82. Lie JT. Illustrated histopathologic classification criteria for selected vasculitis syndromes. American College of Rheumatology Subcommittee on Classification of Vasculitis. <i>Arthritis Rheum</i> 1990; 33(8):1074-1087.	Review/Other-Dx	278 registry patients; 1,079 nonregistry patients	To describe the histopathologic criteria for the diagnosis of 7 selected vasculitis syndromes.	7 selected vasculitis syndromes include polyarteritis nodosa, Churg-Strauss syndrome, Wegener's granulomatosis, hypersensitivity vasculitis, Henoch-Schonlein purpura, GCA, and Takayasu arteritis. The criteria apply to the stereotypical cases in each category.	4
83. Gotthardt M, Bleeker-Rovers CP, Boerman OC, Oyen WJ. Imaging of inflammation by PET, conventional scintigraphy, and other imaging techniques. <i>J Nucl Med</i> 2010; 51(12):1937-1949.	Review/Other-Dx	N/A	To review the rational and efficient use of nuclear medicine imaging techniques in the assessment of patients with osteomyelitis, infected vascular prostheses, metastatic infectious disease, rheumatoid arthritis, vasculitis, inflammatory bowel disease, sarcoidosis, and fever of unknown origin.	With the advent of 3D anatomic imaging, there has been a tendency to replace traditional planar scintigraphy by CT or MRI. Furthermore, scintigraphic techniques may have to be combined with other imaging modalities to achieve high sensitivity and specificity, and some may require time-consuming labeling procedures. On the other hand, new developments such as combined SPECT/CT increase the diagnostic power of scintigraphy. Also, the advent of PET had a considerable impact on the use of nuclear medicine imaging techniques.	4
84. Bley TA, Reinhard M, Hauenstein C, et al. Comparison of duplex sonography and high-resolution magnetic resonance imaging in the diagnosis of giant cell (temporal) arteritis. <i>Arthritis Rheum</i> 2008; 58(8):2574-2578.	Observational-Dx	59 patients	To compare the diagnostic performance of high-resolution MRI and color-coded duplex US in patients with GCA.	36/59 patients (61%) were ultimately diagnosed as having GCA. Sensitivity of high-resolution MRI and color-coded duplex US was 69% and 67%, respectively, specificity was 91% and 91%, PPV was 93% and 92%, and NPV was 66% and 64%, respectively. Temporal artery biopsy findings were positive in 24/41 biopsied patients (59%). Sensitivity of high-resolution MRI and color-coded duplex US compared with temporal artery biopsy was 83% and 79%, respectively, specificity was 71% and 59%, PPV was 80% and 73%, and NPV was 75% and 67%, respectively. The differences between high-resolution MRI and color-coded duplex US were not significant.	3

Headache
EVIDENCE TABLE

Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Study Quality
85. Narvaez J, Narvaez JA, Nolla JM, Sirvent E, Reina D, Valverde J. Giant cell arteritis and polymyalgia rheumatica: usefulness of vascular magnetic resonance imaging studies in the diagnosis of aortitis. <i>Rheumatology (Oxford)</i> 2005; 44(4):479-483.	Review/Other-Dx	6	To report preliminary experience with vascular MRI in the study of the aorta and its proximal branches in patients with GCA and/or polymyalgia rheumatica.	MRI was a helpful noninvasive method for diagnosis of aortitis in all cases, providing accurate information about its extent. In particular, MRI had a higher ability to detect earlier stages of vasculitis disclosing subclinical aortitis in 5/6 patients. The main signs of early vascular inflammation observed were vessel wall thickness and oedema (6 cases) and increased mural enhancement on postcontrast T1-weighted images (4 cases). MRA disclosed lumen changes (stenosis) in 2 patients. On follow-up studies, whereas vascular stenosis and vessel wall thickness remained invariable, vascular wall oedema and contrast enhancement improved significantly when disease activity decreased.	4
86. Bley TA, Wieben O, Uhl M, Thiel J, Schmidt D, Langer M. High-resolution MRI in giant cell arteritis: imaging of the wall of the superficial temporal artery. <i>AJR</i> 2005; 184(1):283-287.	Observational—Dx	20	To investigate the hypothesis that high-resolution MRI can reveal mural inflammatory changes of the superficial temporal artery in GCA.	MRI sharply demonstrated the superficial temporal artery, allowing an evaluation of its lumen and wall. 17 patients were GCA-positive according to criteria of the American College of Rheumatology. Of these 17, 16 had true-positive MRI findings and one had false-negative MRI findings. The 3 patients who were GCA-negative according to the criteria had true-negative MRI findings. The mean thickness of the vessel wall and the lumen diameter were 0.88 +/- 0.23 mm and 0.78 +/- 0.29 mm, respectively, in GCA-positive patients and 0.57 +/- 0.25 mm and 0.7 +/- 0.1 mm, respectively, in GCA-negative patients.	3

Headache
EVIDENCE TABLE

Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Study Quality
87. Karassa FB, Matsagas MI, Schmidt WA, Ioannidis JP. Meta-analysis: test performance of ultrasonography for giant-cell arteritis. <i>Ann Intern Med</i> 2005; 142(5):359-369.	Review/Other-Dx	23 studies involving a total of 2,036 patients	To determine the diagnostic performance of US for GCA.	The weighted sensitivity and specificity of the halo sign were 69% (95% CI, 57% to 79%) and 82% (CI, 75% to 87%), respectively, compared with biopsy and 55% (CI, 36% to 73%) and 94% (CI, 82% to 98%), respectively, compared with ACR criteria. Stenosis or occlusion was an almost equally sensitive marker compared with either biopsy (sensitivity, 68% [CI, 49% to 82%]) or ACR criteria (sensitivity, 66% [CI, 32% to 89%]). Consideration of any vessel abnormality nonsignificantly improved diagnostic performance compared with ACR criteria. Between-study heterogeneity was significant, but summary ROC curves were consistent with weighted estimates. When the pretest probability of GCA is 10%, negative results on US practically exclude the disease (post-test probability, 2% to 5% for various analyses).	4
88. Salvarani C, Cantini F, Boiardi L, Hunder GG. Polymyalgia rheumatica and giant-cell arteritis. <i>N Engl J Med</i> 2002; 347(4):261-271.	Review/Other-Dx	N/A	To review polymyalgia rheumatica and GCA including the epidemiology, pathogenesis, pathological findings, imaging and treatment.	No results stated in abstract.	4
89. Silberstein SD. Headaches in pregnancy. <i>Neurol Clin</i> 2004; 22(4):727-756.	Review/Other-Dx	N/A	To review of diagnosis and treatment of headaches in pregnancy.	Diagnostic testing serves to exclude organic causes of headache, to confirm the diagnosis, and to establish a baseline before treatment. If neurodiagnostic testing is indicated, the study that provides the most information with the least fetal risk is the study of choice.	4
90. Lipton RB, Feraru ER, Weiss G, et al. Headache in HIV-1-related disorders. <i>Headache</i> 1991; 31(8):518-522.	Review/Other-Dx	49	To define the causes, clinical significance and characteristics of headaches in HIV-1-related disorders.	40/49 patients (82%) had an identifiable serious cause of headache. Cryptococcal meningitis (39%) and central nervous system toxoplasmosis (16%) were the leading headache etiologies.	4
91. Sze G, Johnson C, Kawamura Y, et al. Comparison of single- and triple-dose contrast material in the MR screening of brain metastases. <i>AJNR Am J Neuroradiol</i> 1998; 19(5):821-828.	Observational-Dx	92 consecutive patients	To compare the clinical utility of single-dose with triple-dose contrast administration.	In all 70 negative single-dose studies, the triple-dose studies depicted no additional metastases in terms of the standard of reference. No statistically significant difference was seen between the results of the single and triple dose studies.	2

Headache
EVIDENCE TABLE

Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Study Quality
92. Yokoi K, Kamiya N, Matsuguma H, et al. Detection of brain metastasis in potentially operable non-small cell lung cancer: a comparison of CT and MRI. <i>Chest</i> 1999; 115(3):714-719.	Observational-Dx	332 patients	Prospective study to compare the usefulness of MRI and CT in the detection of brain metastases during preoperative evaluation and postoperative follow-up.	MRI detected brain metastases preoperatively in 6/12 patients (3.4% of the total MRI group), whereas CT detected brain metastases preoperatively in 1/11 patients (0.6% of the total CT group). MRI showed a trend toward a higher preoperative detection rate of brain metastases than CT (P=0.069). There was no significant difference between the groups in survival time.	3
93. Castillo M. Imaging of meningitis. <i>Semin Roentgenol</i> 2004; 39(4):458-464.	Review/Other-Dx	N/A	To review conventional MRI of pyogenic meningitis and its complications and the utility of newer techniques; diffusion-weighted imaging, fluid attenuation inversion recovery T2-weighted images, and proton MRS.	No results stated in abstract.	4
94. Kastrup O, Wanke I, Maschke M. Neuroimaging of infections. <i>NeuroRx</i> 2005; 2(2):324-332.	Review/Other-Dx	N/A	To review role of neuroimaging in the diagnosis and therapeutic decision making in infectious diseases of the nervous system.	CT appears to be sufficient for clinical management. MRI is superior in depicting complications. Diffusion-weighted imaging shows early parenchymal complications of meningitis earlier and with more clarity. Proton MRS seems to produce specific peak patterns in cases of abscess.	4

Headache
EVIDENCE TABLE

Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Study Quality
95. Hasbun R, Abrahams J, Jekel J, Quagliarello VJ. Computed tomography of the head before lumbar puncture in adults with suspected meningitis. <i>N Engl J Med</i> 2001; 345(24):1727-1733.	Observational-Dx	301 patients	To investigate whether the absence of certain clinical features at base line could be used to identify adults with suspected meningitis who were unlikely to have abnormal findings on CT of the head.	Of the 301 patients with suspected meningitis, 235 (78%) underwent CT of the head before undergoing lumbar puncture. In 56/235 patients (24%), the results of CT were abnormal; 11 patients (5%) had evidence of a mass effect. The clinical features at base line that were associated with an abnormal finding on CT of the head were an age of at least 60 years, immunocompromised, a history of central nervous system disease, and a history of seizure within one week before presentation, as well as the following neurologic abnormalities: an abnormal level of consciousness, an inability to answer two consecutive questions correctly or to follow two consecutive commands, gaze palsy, abnormal visual fields, facial palsy, arm drift, leg drift, and abnormal language (eg, aphasia). None of these features were present at base line in 96/235 patients who underwent CT scanning of the head (41%). The CT scan was normal in 93/96 patients, yielding a NPV of 97%. Of the three misclassified patients, only one had a mild mass effect on CT, and all three subsequently underwent lumbar puncture, with no evidence of brain herniation one week later.	2
96. Tunkel AR, Hartman BJ, Kaplan SL, et al. Practice guidelines for the management of bacterial meningitis. <i>Clin Infect Dis</i> 2004; 39(9):1267-1284.	Review/Other-Dx	N/A	Practice guidelines to provide clinicians with recommendations for the diagnosis and treatment of bacterial meningitis.	N/A	4
97. Tunkel AR, Glaser CA, Bloch KC, et al. The management of encephalitis: clinical practice guidelines by the Infectious Diseases Society of America. <i>Clin Infect Dis</i> 2008; 47(3):303-327.	Review/Other-Dx	N/A	Practice guidelines to provide health care providers who care for patients with encephalitis.	N/A	4

**Headache
EVIDENCE TABLE**

Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Study Quality
98. Maschke M, Kastrup O, Forsting M, Diener HC. Update on neuroimaging in infectious central nervous system disease. <i>Curr Opin Neurol</i> 2004; 17(4):475-480.	Review/Other-Dx	N/A	To summarize progress in the neuroimaging of infectious central nervous system disease since January 2003, focusing on imaging of viral encephalitis, including that caused by exotic and emerging viruses, and on imaging in immunodeficient patients.	The diagnosis of unclear infectious central nervous system diseases remains a challenge. More recent MRI techniques, such as diffusion-weighted imaging and magnetic resonance spectroscopy, provide additional helpful information. However, the mainstay of diagnosis remains the detection of viral DNA or serological markers of specific infectious agents within the CSF.	4
99. Ramchandren S, Cross BJ, Liebeskind DS. Emergent headaches during pregnancy: correlation between neurologic examination and neuroimaging. <i>AJNR Am J Neuroradiol</i> 2007; 28(6):1085-1087.	Review/Other-Dx	63	Retrospective review to examine demographic and clinical features that are predictive of intracranial pathologic lesions on neuroimaging studies in pregnant women with emergent headaches.	43% of subjects had abnormal neurologic examination findings. Emergent neuroimaging studies may reveal an underlying headache etiology in 27% of pregnant women. Odds of having intracranial pathologic lesions on neuroimaging were 2.7 times higher in patients with abnormal results on neurologic examination (P=.085).	4

**Headache
EVIDENCE TABLE**

Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Study Quality
100. De Luca GC, Bartleson JD. When and how to investigate the patient with headache. <i>Semin Neurol</i> 2010; 30(2):131-144.	Review/Other-Dx	N/A	Review to investigate patients with headache by assessing their history, neurologic, general physical examinations, and diagnostic testing. Certain historical and examination findings increase the likelihood of a secondary headache disorder and the need for diagnostic testing.	Certain historical and examination findings increase the likelihood of a secondary headache disorder and the need for diagnostic testing. These include 1) recent head or neck injury; 2) a new, worse, worsening, or abrupt onset headache; 3) headache brought on by Valsalva maneuver or cough; 4) headache brought on by exertion; 5) headache associated with sexual activity; 6) pregnancy; 7) headache in the patient over the age of ~50; 8) neurologic findings and/or symptoms; 9) systemic signs and/or symptoms; 10) secondary risk factors, such as cancer or HIV infection. Less worrisome are headaches that wake the patient from sleep at night, always occur on the same side, or show a prominent effect of change in posture on the patient's pain. Diagnostic studies include neuroimaging, CSF examination, and blood tests, which are selected depending on the patient's history and findings. For most patients, the diagnostic test of choice is a MRI brain scan. CT of the brain is usually obtained in the setting of trauma or the abrupt onset of headache. CSF examination is useful in diagnosing subarachnoid bleeding, infection, and high and low CSF pressure syndromes.	4
101. Bienfang DC. Overview and differential diagnosis of papilledema. In: Brazis PW, ed. <i>UpToDate</i> . Waltham, MA; 2013.	Review/Other-Dx	N/A	To provide an overview and differential diagnosis of papilledema.	No results stated in abstract.	4
102. Cruz ME, Cruz I, Preux PM, Schantz P, Dumas M. Headache and cysticercosis in Ecuador, South America. <i>Headache</i> 1995; 35(2):93-97.	Observational-Dx	2,723	To determine the prevalence of headache and the yield of CT in a population with endemic neurocysticercosis.	The prevalence of headache was low (68.7/1,000 for migraine headaches and 28.3/1,000 for tension headache). 57 migraine sufferers accepted CT, and in 19 it revealed neurocysticercosis. Of a random sample of 109 headache-free subjects examined by CT, 14 were positive for cysticercosis. A statistically significant difference between the symptom-free general population and the migraine patients was obtained for CT findings (odds ratio 3.39, P<0.005).	3

Headache
EVIDENCE TABLE

Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Study Quality
103. Chiewvit P, Piyapittayan S, Pongvarin N. Cerebral venous thrombosis: diagnosis dilemma. <i>Neurol Int</i> 2011; 3(3):e13.	Review/Other-Dx	N/A	To review etiology, incidence, imaging modalities and treatment of cerebral venous thrombosis.	Prompt investigation by noninvasive imaging MR or advanced modalities such as cerebral venous thrombosis, MR venography will be helpful in prompt diagnosis and treatment. These imaging modalities may reveal either direct sign (visualization of intraluminal clot) and indirect signs (paranchymatous change, intracranial hemorrhage).	4
104. Filippidis A, Kapsalaki E, Patramani G, Fountas KN. Cerebral venous sinus thrombosis: review of the demographics, pathophysiology, current diagnosis, and treatment. <i>Neurosurg Focus</i> 2009; 27(5):E3.	Review/Other-Dx	N/A	To review demographics, pathophysiology, and current diagnosis of cerebral venous sinus thrombosis.	Diagnosis of cerebral venous sinus thrombosis is established with the implementation of neuroimaging studies, especially MRI and venography. Recent advances in the diagnosis and treatment of patients with cerebral venous sinus thrombosis have significantly lowered the associated mortality and morbidity and have improved the outcome of these patients.	4
105. Leach JL, Fortuna RB, Jones BV, Gaskill-ShIPLEY MF. Imaging of cerebral venous thrombosis: current techniques, spectrum of findings, and diagnostic pitfalls. <i>Radiographics</i> 2006; 26 Suppl 1:S19-41; discussion S42-13.	Review/Other-Dx	N/A	To review current techniques, spectrum of findings, and diagnostic pitfalls in imaging cerebral venous thrombosis.	MRI, unenhanced CT, unenhanced TOF MR venography, and contrast material-enhanced MR venography and CT venography are useful techniques for detecting cerebral venous and brain parenchymal changes that may be related to thrombosis.	4
106. Lee AG, Wall M. Idiopathic intracranial hypertension (pseudotumor cerebri): Clinical features and diagnosis. In: Brazis PW, ed. <i>UpToDate</i> . Waltham, MA; 2013.	Review/Other-Dx	N/A	To discuss the clinical features and diagnosis of idiopathic intracranial hypertension.	No results stated in abstract.	4
107. Hong M, Shah GV, Adams KM, Turner RS, Foster NL. Spontaneous intracranial hypotension causing reversible frontotemporal dementia. <i>Neurology</i> 2002; 58(8):1285-1287.	Review/Other-Dx	1 patient	The study examined a 66-year-old man with chronic headache and progressive personality and behavioral changes typical of frontotemporal dementia.	The man had MRI findings of SIH with low CSF pressure. His headache, dementia, and imaging abnormalities abated after treatment with prednisone. SIH can cause reversible frontotemporal dementia, and should be considered when dementia and behavioral changes are accompanied by headache.	4
108. Mokri B, Ahlskog JE, Luetmer PH. Chorea as a manifestation of spontaneous CSF leak. <i>Neurology</i> 2006; 67(8):1490-1491.	Review/Other-Dx	1 patient	The study examined a 59-year-old man presented with orthostatic headaches, memory complaints, pronounced choreiform movements, and related hyperkinetic dysarthria and titubations.	Head MRI findings were suggestive of CSF leak. CSF pressure was low. CT myelography documented CSF leak at the cervicothoracic junction. Targeted epidural blood patch led to resolution of symptoms, including complete disappearance of choreiform movements.	4

**Headache
EVIDENCE TABLE**

Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Study Quality
109. Pleasure SJ, Abosch A, Friedman J, et al. Spontaneous intracranial hypotension resulting in stupor caused by diencephalic compression. <i>Neurology</i> 1998; 50(6):1854-1857.	Review/Other-Dx	1 patient	The study examined a 51-year-old man who had a 4-month history of progressive headache and gradual onset of somnolence.	MRI suggested SIH with diencephalic compression, but he did not improve after 3 epidural blood patches. He became alert following intrathecal saline infusion that normalized his CSF pressure. A CSF leak was noted on spinal MRI and confirmed with CT contrast myelography. Surgical ligation of a torn dural root sleeve isolating a ruptured Tarlov's cyst resulted in permanent cure.	4
110. Schievink WI, Maya MM. Quadriplegia and cerebellar hemorrhage in spontaneous intracranial hypotension. <i>Neurology</i> 2006; 66(11):1777-1778.	Review/Other-Dx	N/A	No abstract available.	No abstract available.	4
111. Whiteley W, Al-Shahi R, Myles L, Lueck CJ. Spontaneous intracranial hypotension causing confusion and coma: a headache for the neurologist and the neurosurgeon. <i>Br J Neurosurg</i> 2003; 17(5):456-458.	Review/Other-Dx	1 patient	A case is presented and the clinical features of SIH are discussed.	No results stated in abstract.	4
112. Schievink WI, Maya MM, Louy C, Moser FG, Tourje J. Diagnostic criteria for spontaneous spinal CSF leaks and intracranial hypotension. <i>AJNR Am J Neuroradiol</i> 2008; 29(5):853-856.	Observational-Dx	107 consecutive patients	A new set of diagnostic criteria for spontaneous spinal CSF leaks and SIH encompassing its varied clinical and radiographic manifestations is presented. The intent of these criteria is to present a diagnostic scheme that can be used to more reliably diagnose spontaneous spinal CSF leaks and intracranial hypotension.	The diagnosis was confirmed in 94 patients, with use of criterion A in 78 patients, criterion B in 11 patients, and criterion C in 5 patients.	4
113. Cutrer FM. Primary cough headache. In: Swanson JW, ed. <i>UpToDate</i> . Waltham, MA; 2013.	Review/Other-Dx	N/A	To review primary cough headache.	No results stated in abstract.	4

**Headache
EVIDENCE TABLE**

Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Study Quality
114. Pascual J, Iglesias F, Oterino A, Vazquez-Barquero A, Berciano J. Cough, exertional, and sexual headaches: an analysis of 72 benign and symptomatic cases. <i>Neurology</i> 1996; 46(6):1520-1524.	Review/Other-Dx	72 patients	To analyze cough, exertional, and vascular sexual headaches, to evaluate the interrelationships among them, and examine the possible symptomatic cases.	72 patients consulted because of headaches precipitated by coughing (n=30), physical exercise (n=28), or sexual excitement (n=14). 30 (42%) were symptomatic. The 17 cases of symptomatic cough headache were secondary to Chiari type I malformation, while the majority of cases of symptomatic exertional headaches and the only case of symptomatic sexual headache were secondary to SAH. Although the precipitant was the same, benign and symptomatic headaches differed in several clinical aspects, such as age at onset, associated clinical manifestations, or response to pharmacologic treatment. Although sharing some properties, such as male predominance, benign cough headache and benign exertional headache are clinically separate conditions. Benign cough headache began significantly later, 43 years on average, than benign exertional headache. By contrast, findings suggest that there is a close relationship between benign exertional headache and benign vascular sexual headache.	4
115. Rasmussen BK, Olesen J. Symptomatic and nonsymptomatic headaches in a general population. <i>Neurology</i> 1992; 42(6):1225-1231.	Review/Other-Dx	N/A	To assess the lifetime prevalence's of headache disorders in a cross-sectional epidemiologic survey of a representative 25- to 64-year-old general population.	Lifetime prevalence of idiopathic stabbing headache was 2%, of external compression headache 4%, and of cold stimulus headache 15%. Benign cough headache, benign exertional headache, and headache associated with sexual activity each occurred in 1%. Lifetime prevalence of hangover headache was 72%, of fever headache 63%, and of headache associated with disorders of nose or sinuses 15%.	4

Headache
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Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Study Quality
116. Sjaastad O, Bakketeig LS. Exertional headache. I. Vaga study of headache epidemiology. <i>Cephalalgia</i> 2002; 22(10):784-790.	Review/Other-Dx	1,838 patients	To assess the prevalence ('life-time') and manifestations of exertional headache and to validate some of the clinical diagnostic criteria.	With the criteria used, the prevalence was 12.3%. There was a slight but significant female preponderance (F/M ratio 1.38). There was a mixture of short- and more long-lasting attacks. Attacks followed long-lasting and strenuous effort/exhaustion. The precipitation mechanisms differed essentially from the cough/sneezing type of provocation. Blinded recheck of records (n=100) as well as recheck of dalesmen (n=41) showed high kappa values. The clinical manifestations differed essentially from Rooke's (1968) description (that mainly dealt with the 'cough headache'-type). The present findings were similar to those in Pascual's description of exertional headache from 1996.	4
117. Cutrer FM. Primary exertional headache. In: Swanson JW, ed. <i>UpToDate</i> . Waltham, MA; 2013.	Review/Other-Dx	N/A	To review primary exertional headache.	No results stated in abstract.	4
118. Cutrer FM. Primary headache associated with sexual activity. In: Swanson JW, ed. <i>UpToDate</i> . Waltham, MA; 2013.	Review/Other-Dx	N/A	To review primary headache associated with sexual activity.	No results stated in abstract.	4
119. Finkel AG. American Headache Society. Concussion and Post-Traumatic Headache. http://www.americanheadachesociety.org/assets/1/7/Alan_Finkel_-_Concussion_and_PTH.pdf . Accessed 28 January 2013.	Review/Other-Dx	N/A	No abstract available.	No abstract available.	4
120. Lenaerts ME. Post-traumatic headache: from classification challenges to biological underpinnings. <i>Cephalalgia</i> 2008; 28 Suppl 1:12-15.	Review/Other-Dx	N/A	To review the ICHD-II criteria for post-traumatic headache.	No results stated in abstract.	4
121. American College of Radiology. <i>Manual on Contrast Media</i> . Available at: http://www.acr.org/~link.aspx?id=29C40D1FE0EC4E5EAB6861BD213793E5&amp;_z=z .	Review/Other-Dx	N/A	Guidance document on contrast media to assist radiologists in recognizing and managing risks associated with the use of contrast media.	N/A	4

Evidence Table Key

Study Quality Category Definitions

- *Category 1* The study is well-designed and accounts for common biases.
- *Category 2* The study is moderately well-designed and accounts for most common biases.
- *Category 3* There are important study design limitations.
- *Category 4* The study is not useful as primary evidence. The article may not be a clinical study or the study design is invalid, or conclusions are based on expert consensus. For example:
 - a) the study does not meet the criteria for or is not a hypothesis-based clinical study (e.g., a book chapter or case report or case series description);
 - b) the study may synthesize and draw conclusions about several studies such as a literature review article or book chapter but is not primary evidence;
 - c) the study is an expert opinion or consensus document.

Dx = Diagnostic

Tx = Treatment

Abbreviations Key

AVM = Arteriovenous malformations

CI = Confidence interval

CSF = Cerebrospinal fluid

CT = Computed tomography

CTA = Computed tomography angiography

DSA = Digital-subtraction angiography

ED = Emergency department

GCA = Giant cell arteritis

ICA = Internal carotid artery

MRA = Magnetic resonance angiography

MRI = Magnetic resonance imaging

MRS = Magnetic resonance spectroscopy

NPV = Negative predictive value

PET = Positron emission tomography

PPV = Positive predictive value

SAH = Subarachnoid hemorrhage

SIH = Spontaneous intracranial hypotension

SPECT = Single-photon emission tomography

TIA = Transient ischemic attack

TN = Trigeminal neuralgia

TOF = Time-of-flight

US = Ultrasound