Headache-Child
EVIDENCE TABLE

Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Study Quality
1. Lateef TM, Grewal M, McClintock W, Chamberlain J, Kaulas H, Nelson KB. Headache in young children in the emergency department: use of computed tomography. Pediatrics. 2009; 124(1):e12-17.	Observational-Dx	364 children	To determine whether CT scans led to better acute care of young children with headache presenting to the emergency department.	On the basis of initial history and physical examination results, 306 children (84%) had secondary headaches. For 72% of those children, acute febrile illnesses and viral respiratory syndromes accounted for the headaches. Among the 58 children (16%) who had no recognized central nervous system disease or systemic illness at presentation, 28% had CT scans performed. Of those, 1 scan yielded abnormal results, showing a brainstem glioma; the patient demonstrated abnormal neurologic examination findings on the day of presentation. For 15 (94%) of 16 patients, the CT scans did not contribute to diagnosis or management. For 59% of children with apparently primary headaches, no family history was recorded. For young children presenting to the emergency department with headache but normal neurologic examination findings and no worrying history, CT scans seldom lead to diagnosis or contribute to immediate management.	4
2. Lewis DW, Ashwal S, Dahl G, et al. Practice parameter: evaluation of children and adolescents with recurrent headaches: report of the Quality Standards Subcommittee of the American Academy of Neurology and the Practice Committee of the Child Neurology Society. Neurology. 2002; 59(4):490-498.	Review/Other-Dx	N/A	Review available evidence on the evaluation of the child with recurrent headaches and make recommendations based on this evidence.	Recurrent headaches occur commonly in children and are diagnosed on a clinical basis rather than by any testing. The routine use of any diagnostic studies is not indicated when the clinical history has no associated risk factors and the child's examination is normal.	4
3. International Headache Society. ICHD / Guidelines. Available at: http://www.ihs-headache.org/ichd-guidelines.	Review/Other-Dx	N/A	Guidelines from the International Headache Society.	No abstract available.	4

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Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Study Quality
4. Arruda MA, Guidetti V, Galli F, Albuquerque RC, Bigal ME. Primary headaches in childhood--a population-based study. Cephalalgia. 2010; 30(9):1056-1064.	Review/Other-Dx	1,994 children	Population-based study. To estimate the prevalence of primary headaches in pre-adolescent children, as well as headache frequency and days of treatment in this population.	The overall prevalence of migraine was 3.76%, non-significantly higher in boys (3.9%) than in girls (3.6%). Prevalence of probable migraine was significantly higher than the prevalence of migraine for all ages (overall prevalence of 17.1%). Chronic migraine happened in 0.8% (girls, 1.15%; boys, 0.5%). Infrequent episodic tension-type headache happened in 2.3% of the sample while prevalence of frequent episodic tension-type headache was 1.6%. Probable episodic tension-type headache happened in 13.5%. Most children with migraine had consulted a medical doctor because of their headaches, and the proportion was higher among children with chronic migraine (93.7%). Prevalence of primary headaches is high in young children. Probable diagnoses are more common than full diagnoses. Consultation rates are elevated.	4
5. Schwedt TJ, Guo Y, Rothner AD. "Benign" imaging abnormalities in children and adolescents with headache. Headache. 2006; 46(3):387-398.	Review/Other-Dx	241 patients	To study the frequency of "benign" abnormalities on brain imaging in children with headache, compare it with the frequency of imaging findings that dictate a change in patient management, and determine the association of benign findings with headache.	Approximately 20% of pediatric headache patients with brain imaging have benign abnormalities that do not result in a change in headache management. Imaging findings that require a change in management are rare in patients with an absence of abnormal neurologic symptoms and signs, occurring in 1.2% of patients imaged in this study.	4
6. Sempere AP, Porta-Etessam J, Medrano V, et al. Neuroimaging in the evaluation of patients with non-acute headache. Cephalalgia. 2005; 25(1):30-35.	Observational-Dx	1,876 consecutive patients	Prospective study 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 authors to rule out such abnormalities.	3

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Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Study Quality
7. Nallasamy K, Singhi SC, Singhi P. Approach to headache in emergency department. Indian J Pediatr. 79(3):376-80, 2012 Mar.	Review/Other-Dx	N/A	To evaluate the approach to headache in the emergency department	No results stated in abstract.	4
8. Raieli V, Eliseo M, Pandolfi E, et al. Recurrent and chronic headaches in children below 6 years of age. J Headache Pain. 2005; 6(3):135-142.	Review/Other-Dx	1,598 medical records of children; 105 children below 6 years	To determine the frequency of headache subtypes, according to International Headache Society (IHS) criteria, in a population of children below 6 years visiting a Center for Diagnosis and Treatment of Headache in Youth.	According to the IHS criteria authors found 37 cases (35.2%) with migraine, 19 cases (18%) with episodic tension headache, 5 cases (4.8%) with chronic daily headache, 13 cases (12.4%) with primary stabbing headache, 18 cases (17.1%) with post-traumatic headache, 7 cases (6.6%) with other non-dangerous secondary headaches (otorhinolaryngological diseases, post-infectious headaches), 3 cases (2.85%) with dangerous headaches (Arnold-Chiari type 1 malformation, brain tumor) and 9 cases (8.6%) with unclassifiable headaches. Six children (5.7%) reported more than one headache subtype. The prevalence of dangerous headaches was higher than those in school age (chi(2)=4.70, P<0.05). Study shows some differences in headaches in this population vs school children. In fact, at this age migraine is the most common headache, but we also found an increase of secondary causes among the chronic/recurrent and daily headaches, especially post-traumatic disorders and potentially dangerous headaches. Finally study shows the highest prevalence of the idiopathic stabbing headache in pre-school children in comparison with other ages.	4
9. Alexiou GA, Argyropoulou MI. Neuroimaging in childhood headache: a systematic review. [Review]. Pediatr Radiol. 43(7):777-84, 2013 Jul.	Review/Other-Dx	N/A	To discuss the evaluation and diagnosis of headache by means of CT or MRI as part of an investigation.	No results listed in abstract.	4

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Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Study Quality
10. DeVries A, Young PC, Wall E, et al. CT scan utilization patterns in pediatric patients with recurrent headache. Pediatrics. 132(1):e1-8, 2013 Jul.	Observational-Dx	15,836 patients	To determine current practice patterns of neuroimaging to diagnose pediatric headache in a variety of treatment settings and to identify factors associated with increased use of neuroimaging.	Of 15 836 patients, 26% (4034 patients; mean age: 11.8 years) had >/=1 CT scan, 74% within 1 month of index diagnosis. Patients with ED visits were 4 times more likely to undergo a CT scan versus those without ED visits (P < .001 [95% confidence interval: 3.9-4.8]). However, even outside the ED, use of CT scans remained widespread. Two-thirds of patients with CT scans had no ED use.Among patients with no ED utilization, >20% received a CT scan during the study period. Evaluation by a neurologist was strongly associated with a lower likelihood of CT scan compared with other provider specialties (odds ratio: 0.37; P < .01 [95% confidence interval: 0.30-0.46]).	3
11. Martens D, Oster I, Gottschlling S, et al. Cerebral MRI and EEG studies in the initial management of pediatric headaches. Swiss Med Wkly. 142:w13625, 2012 Jul 10.	Observational-Dx	209 patients	To evaluate the role of cerebral MRI (cMRI) and EEG in the initial assessment of children with headache as the chief complaint of initial presentation.	209 patients were included in this study [mean age 11.3 years; male 91 (43.5%); female 118 (56.5%)]. The following types of headaches were seen: Unclassified headache: 23.4%; probable migraine 17.2%, migraine without aura 13.4%, complicated migraine 12.4%, migraine with aura 1.0%; tension-type 15.3%, and cluster headaches 0.5%, and secondary headaches 16.7%. In 93 children (44.5%) abnormal physical/neurological findings were noted (multiple entries possible). On cMRI studies the following findings were seen: Infection of sinuses (7.2%), pineal cysts (2.4%), arachnoidial cyst and Chiari malformation (1.9%), unspecified signal enhancement (1.0%), and pituitary enlargement, inflammatory lesion, angioma, cerebral ischaemia, and intra-cerebral cyst (each 0.5%). Electroencephalographic findings included both focal and generalised abnormal slowing (5.3%) and Spike-wave complexes (3.3%).	3

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Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Study Quality
12. Yilmaz U, Celegen M, Yilmaz TS, Gurcinar M, Unalp A. Childhood headaches and brain magnetic resonance imaging findings. Europ J Paediatr Neurol. 18(2):163-70, 2014 Mar.	Observational-Dx	449 children	To determine headache types and to evaluate the frequency and clinical significance of brain MRI abnormalities in children with headache.	The causes of headache were migraine in 247 (55.0%), tension-type in 133 (29.6%), secondary in 48 (10.7%), and unspecified headaches in 21 (4.7%) patients. Overall, 324 (72.2%) patients underwent cerebral MRI, which revealed abnormalities in 68 (21.0%) patients. Two (0.6%) patients had cerebral MRI abnormalities relevant to headache, including tumor and hydrocephalus each 1 (0.3%). Twenty-nine (8.9%) patients had incidental cerebral MRI abnormalities including 14 (4.3%) white-matter hyperintensities, 4 (1.2%) old infarcts, 3 (0.9%) Chiari malformations, arachnoid cysts and demyelinating lesions each 2 (0.6%), and subdural hygroma, fibrous dysplasia, pineal cyst and perivascular widening, each 1 (0.3%). Remaining 36 (11.1%) patients had extra-cerebral MRI abnormalities including 34 (10.5%) sinus disease, and 2 (0.6%) adenoid vegetation. Indications for brain MRI were atypical headache pattern or presence of neurologic abnormalities in 59 (18.2%) patients and parents' concerns in 265 (81.8%) patients. The rates of abnormal MRI findings were similar between these 2 groups.	3

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EVIDENCE TABLE

Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Study Quality
13. Rho YI, Chung HJ, Suh ES, et al. The role of neuroimaging in children and adolescents with recurrent headaches--multicenter study. Headache. 2011;51(3):403-408.	Review/Other-Dx	1562 patients	To evaluate the role of neuroimaging and to estimate the prevalence of significant and treatable intracranial lesions in children and adolescents with recurrent headaches.	Neuroimaging procedures were performed in 77.1% of the patients. Overall, 9.3% (112/1204) of the patients had abnormal findings from neuroimaging. The highest yield was in patients with an abnormal neurological examination wherein abnormal findings on neuroimaging were seen in 50.0% (9/18) of patients ($P < .001$). The yield was low when imaging was carried out in view of changes in the type of headache (12.9% [26/201]), neurologic dysfunction (10.8% [9/83]), recent onset of severe headaches (7.0% [12/171]), and demands of parent and physicians (10.1% [21/208]). Eleven patients underwent surgery based on neuroimaging results. There was no significant relation between abnormality on neuroimaging and age, sex, headache type, age of onset of headache, duration of symptoms before presentation, duration, frequency, location and intensity of headache ($P > .05$).	4
14. Roser T, Bonfert M, Ebinger F, Blankenburg M, Ertl-Wagner B, Heinen F. Primary versus secondary headache in children: a frequent diagnostic challenge in clinical routine. [Review]. Neuropediatrics. 44(1):34-9, 2013 Feb.	Review/Other-Dx	N/A	To review subtle signs in history and physical examination that raise suspicion of intracranial pathology.	No results stated in abstract.	4

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EVIDENCE TABLE

Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Study Quality
15. Abu-Arafeh I, Macleod S. Serious neurological disorders in children with chronic headache. Arch Dis Child. 2005; 90(9):937-940.	Review/Other-Dx	815 children and adolescents	To determine the prevalence of serious neurological disorders among children with chronic headache.	A total of 815 children and adolescents (1.25-18.75 years of age, mean 10.8 years (SD 2.9); 432 male) were assessed. Mean duration of headache was 21.2 months (SD 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). Fifty one children (6.3%) had other chronic neurological disorders that were unrelated to the headache. The headache in three children (0.37%, 95% CI 0.08% to 1.1%) was related to active intracranial pathology which was predictable on clinical findings in two children but was unexpected until a later stage in one child (0.12%, 95% CI 0.006% to 0.68%).	4
16. American College of Radiology. ACR Appropriateness Criteria®: Head Trauma — Child. Available at: https://acsearch.acr.org/docs/3083021/Narrative/.	Review/Other-Dx	N/A	To evaluate the appropriateness of imaging procedures for patients with head trauma	No abstract available.	4
17. Dowling MM, Noetzel MJ, Rodeghier MJ, et al. Headache and migraine in children with sickle cell disease are associated with lower hemoglobin and higher pain event rates but not silent cerebral infarction. J Pediatr. 164(5):1175-1180.e1, 2014 May.	Observational-Dx	872 children	To identify risk factors for headache and migraine in children with sickle cell disease and test the hypothesis that either or both are independently associated with silent cerebral infarcts.	The cohort included 872 children (51.1% males), ranging in age from 5 to 15 years (mean age, 9.1 years). Of these children, 317 (36.4%) reported recurrent headaches, and 132 (15.1%) reported migraines. In multivariable logistic regression analyses, both were associated with lower steady-state hemoglobin ($P = .01$ for headaches; $P < .01$ for migraines) and higher pain rate ($P < .01$ for headaches; $P < .01$ for migraines), defined as the number of admissions requiring opioids in the previous 3 years. The presence of silent cerebral infarction was not associated with recurrent headaches or migraines. Only 1.9% (6 of 317) of children with recurrent headaches received medication for headache prophylaxis.	3

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Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Study Quality
18. Ozge A, Termine C, Antonaci F, Natriashvili S, Guidetti V, Wober-Bingol C. Overview of diagnosis and management of paediatric headache. Part I: diagnosis. J Headache Pain. 2011;12(1):13-23.	Review/Other-Dx	N/A	To review the diagnosis and management of pediatric headache.	No results stated in abstract.	4
19. American College of Radiology. ACR Appropriateness Criteria®: Seizures — Child. Available at: https://acsearch.acr.org/docs/69441/Narrative/.	Review/Other-Dx	N/A	To provide guidelines for pediatric seizures.	No abstract available.	4
20. Mortimer AM, Bradley MD, Stoodley NG, Renowden SA. Thunderclap headache: diagnostic considerations and neuroimaging features. [Review]. Clin Radiol. 68(3):e101-13, 2013 Mar.	Review/Other-Dx	N/A	To discuss the diagnostic considerations and neuroimaging features of thunderclap headache	No results listed in abstract.	4
21. Bederson JB, Connolly ES, Jr., Batjer HH, et al. Guidelines for the management of aneurysmal subarachnoid hemorrhage: a statement for healthcare professionals from a special writing group of the Stroke Council, American Heart Association. Stroke. 2009;40(3):994-1025.	Review/Other-Tx	N/A	To summarize the best available evidence for treatment of patients with aneurysmal SAH and to identify areas of future research.	The current standard of practice calls for microsurgical clipping or endovascular coiling of the aneurysm neck whenever possible. Treatment morbidity is determined by numerous factors, including patient, aneurysm, and institutional factors. Favorable outcomes are more likely in institutions that treat high volumes of patients with SAH, in institutions that offer endovascular services, and in selected patients whose aneurysms are coiled rather than clipped. Optimal treatment requires availability of both experienced cerebrovascular surgeons and endovascular surgeons working in a collaborative effort to evaluate each case of SAH.	4
22. Morgenstern LB, Hemphill JC, 3rd, Anderson C, et al. Guidelines for the management of spontaneous intracerebral hemorrhage: a guideline for healthcare professionals from the American Heart Association/American Stroke Association. Stroke. 2010;41(9):2108-2129.	Review/Other-Dx	N/A	To present current and comprehensive recommendations for the diagnosis and treatment of acute spontaneous intracerebral hemorrhage.	Evidence-based guidelines are presented for the care of patients presenting with intracerebral hemorrhage. The focus was subdivided into diagnosis, hemostasis, blood pressure management, inpatient and nursing management, preventing medical comorbidities, surgical treatment, outcome prediction, rehabilitation, prevention of recurrence, and future considerations.	4

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Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Study Quality
23. American College of Radiology. ACR Appropriateness Criteria®: Sinusitis — Child. Available at: https://acsearch.acr.org/docs/69442/Narrative/.	Review/Other-Dx	N/A	To evaluate the appropriateness of initial radiologic examinations for patients with seizures and epilepsy	No abstract available.	4
24. Degnan AJ, Levy LM. Pseudotumor cerebri: brief review of clinical syndrome and imaging findings. AJNR Am J Neuroradiol. 2011;32(11):1986-1993.	Review/Other-Dx	N/A	To provide a brief review of clinical syndrome and imaging findings for pseudotumor cerebri (PTC)	PTC is a clinical entity of uncertain etiology characterized by intracranial hypertension. The syndrome classically manifests with headaches and visual changes in women with obesity. Traditionally, imaging ruled out secondary causes of elevated CSF pressure but now may reveal findings frequently seen in patients with PTC, including the following: flattening of the globe, an empty sella, an enlarged ONS, protrusion and enhancement of the optic nerve head, and increased tortuosity of the optic nerve. Novel imaging methods, including MR venography, have additionally identified sinovenous stenosis as a potential indicator of PTC.	4
25. Linn J, Ertl-Wagner B, Seelos KC, et al. Diagnostic value of multidetector-row CT angiography in the evaluation of thrombosis of the cerebral venous sinuses. AJNR. 2007; 28(5):946-952.	Observational-Dx	19 patients; 3 blinded readers	To determine the diagnostic value of MDCTA as a fast and cost-effective imaging tool in diagnosing cerebral venous and sinus thrombosis. MR venography used as reference standard.	The consensus reading revealed cerebral venous and sinus thrombosis in 10/19 patients. With MDCTA, the venous sinuses could be identified in 99.2% and the cerebral veins in 87.6% of cases. The sensitivity and specificity of MDCTA for the diagnosis of cerebral venous and sinus thrombosis were 100%. Study demonstrates that MDCTA provides excellent sensitivity and specificity for the diagnosis of cerebral venous and sinus thrombosis. Further studies are needed to evaluate the diagnostic potential of MDCTA in specific subsets of the general entity of cerebral venous and sinus thrombosis such as cortical venous thrombosis, thrombosis of the cavernous sinus, and thrombosis of the internal cerebral veins.	3

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Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Study Quality
26. Abend NS, Younkin D, Lewis DW. Secondary headaches in children and adolescents. Semin Pediatr Neurol. 2010; 17(2):123-133.	Review/Other-Dx	N/A	Review the diverse collection of medical and systemic causes of headache in children according to the International Classification of Headache Disorders (ICHD-II).	In most cases, a thorough medical and headache history coupled with physical and neurologic examination will uncover clues to the presence of these other disorders. This will also guide clinical decision making regarding the need for further diagnostic testing, including neuroimaging, electrophysiological testing, or specific laboratory testing.	4
27. American College of Radiology. ACR Appropriateness Criteria®: Cerebrovascular Disease. Available at: https://acsearch.acr.org/docs/69478/Narrative/.	Review/Other-Dx	N/A	Evidence-based guidelines to assist referring physicians and other providers in making the most appropriate imaging or treatment decision for a specific clinical condition.	N/A	4
28. Gelfand AA, Reider AC, Goadsby PJ. Cranial autonomic symptoms in pediatric migraine are the rule, not the exception. Neurology. 2013;81(5):431-436.	Review/Other-Dx	125 pediatric patients	To examine the frequency of cranial autonomic symptoms in pediatric/adolescent patients with migraine.	Of 125 pediatric migraineurs, 62% had at least one cranial autonomic symptom based on current International Classification of Headache Disorders, second edition (ICHD-II) criteria, and 70% based on proposed ICHD-III criteria. The majority had more than one cranial autonomic symptom and the symptoms tended to be bilateral. Age, sex, laterality of headache, presence of aura, and whether migraine was episodic vs chronic did not influence the likelihood of having cranial autonomic symptoms.	4
29. American College of Radiology. ACR Appropriateness Criteria®: Suspected Physical Abuse–Child. Available at: https://acsearch.acr.org/docs/69443/Narrative/.	Review/Other-Dx	N/A	To provide guidelines on suspected physical abuse for the pediatric population.	No abstract available.	4
30. The epidemiology of headache among children with brain tumor. Headache in children with brain tumors. The Childhood Brain Tumor Consortium. J Neurooncol. 1991; 10(1):31-46.	Review/Other-Dx	3,291 patients	To present aspects of the epidemiology of headache (ie, pain in the head, face, ear, or neck) among children with brain tumors.	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

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Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Study Quality
31. Medina LS, Pinter JD, Zurakowski D, Davis RG, Kuban K, Barnes PD. Children with headache: clinical predictors of surgical space-occupying lesions and the role of neuroimaging. Radiology. 1997; 202(3):819-824.	Observational-Dx	315 patients	Retrospective study to determine clinical predictors useful in differentiation of surgical lesions from medically treated disorders and the role of neuroimaging in children with headache.	Seven independent multivariate predictors of a surgical lesion were identified. Sleep-related headache and no family history of migraine were the strongest predictors. A positive correlation between number of predictors and risk of surgical lesion was noted (P<.0001). No difference between MRI and CT was noted in detection of surgical space-occupying lesions, and there were no false-positive or false-negative surgical lesions detected with either modality on the basis of clinical follow-up. Children at high risk on the basis of these criteria usually require neuroimaging, while children at low risk may be safely followed up clinically without neuroimaging.	3
32. Reulecke BC, Erker CG, Fiedler BJ, Niederstadt TU, Kurlemann G. Brain tumors in children: initial symptoms and their influence on the time span between symptom onset and diagnosis. J Child Neurol. 2008; 23(2):178-183.	Observational-Dx	245 consecutive patients	Retrospective study to detect factors influencing the time span between the occurrence of symptoms and the diagnosis to alert health professionals to the early symptoms of pediatric brain tumors.	Multivariate analysis showed a significant influence of 6 parameters on the interval between symptom onset and diagnosis. An additional symptom had a significant influence on the time span between symptom onset and diagnosis in the univariate analysis. The findings that several symptoms influence the interval between symptom onset and diagnosis emphasize the necessity to systematically inquire about the key symptoms of brain tumors. The challenge for every consultant is to decide in which cases cerebral imaging is appropriate. As the most frequent symptoms are unspecific and often underestimated, a detailed anamnesis is crucial to detect possible brain tumor patients. In doubtful cases, a systematic interrogation regarding the catalogue of symptoms can be helpful.	4

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Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Study Quality
33. Alperin N, Ranganathan S, Bagci AM, et al. MRI evidence of impaired CSF homeostasis in obesity-associated idiopathic intracranial hypertension. AJNR Am J Neuroradiol. 34(1):29-34, 2013 Jan.	Observational-Dx	22 women	To measure intracranial CSF volumes and cerebral venous drainage with MR imaging to determine whether increased CSF volume from impaired CSF homeostasis and venous hemodynamics occur in obesity-related IIH.	Findings confirm normal ventricular volume in IIH. However, extraventricular CSF volume is significantly increased in IIH (290 +/- 52 versus 220 +/- 24 mL, P = .001). This is even more significant after normalization with intracranial volume (P = .0007). GM interstitial fluid volume is also increased in IIH (602 +/- 57 versus 557 +/- 31 mL, P = .037). Total arterial inflow is normal, but relative venous drainage through the IJV is significantly reduced in IIH (65 +/- 7% versus 81 +/- 10%, P = .001).	3
34. Friedman DI, Liu GT, Digre KB. Revised diagnostic criteria for the pseudotumor cerebri syndrome in adults and children. Neurology. 81(13):1159-65, 2013 Sep 24.	Review/Other-Dx	N/A	To provide diagnostic criteria for pseudotumor cerebri syndrome in adults and children.	No results stated in abstract.	4
35. Toldo I, Tangari M, Mardari R, et al. Headache in children with Chiari I malformation. Headache. 54(5):899-908, 2014 May.	Observational-Dx	45 cases	To evaluate the frequency and the characteristics of headache in children with Chiari 1 malformation at initial evaluation and during follow up.	Possible associations between clinical picture, in particular headache pattern, but also other signs and symptoms attributable to Chiari 1 malformation, and the extent of tonsillar ectopia were found for 3 different groups: those with borderline (<5 mm, N = 12), mild (5-9 mm, N = 27), and severe tonsillar ectopia (>/=10 mm, N = 6), respectively. Twenty-four out of 33 (73%) cases with Chiari 1 malformation complained of headache, and 9/33 (27%) of those patients (5 with mild and 4 with severe tonsillar ectopia) reported headache attributed to Chiari 1 malformation.	2
36. Victorio MC, Khoury CK. Headache and Chiari I Malformation in Children and Adolescents. [Review]. Semin Pediatr Neurol. 23(1):35-9, 2016 Feb.	Review/Other-Dx	N/A	To discuss headache and Chiari I malformation in children and adolescents	No results listed in abstract.	4
37. Eidlitz-Markus T, Zeharia A, Haimi-Cohen Y, Konen O. Occipital and craniocervical pain and brain MRI in children with migraine. Pediatr Neurol. 2014;50(4):347-352.	Observational-Dx	194 patients	To evaluate the frequency of cervical and occipital pain in children and adolescents with migraine as opposed to other types of headache and to seek corresponding anatomic abnormalities on brain magnetic resonance imaging.	Patients were divided into two groups: migraine headache (n = 125) and other types of headache (n = 69). Occipital pain was reported by 16.4% of the patients and cervical pain by 4.1%; neither type of pain was characteristic of migraine headache in particular. Brain magnetic resonance imaging did not show any anatomic changes specific to migraine or other headache types, regardless of the presence of occipital or cervical pain.	3

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Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Study Quality
38. Hines PC, McKnight TP, Seto W, Kwiatkowski JL. Central nervous system events in children with sickle cell disease presenting acutely with headache. J Pediatr. 159(3):472-8, 2011 Sep.	Observational-Dx	73 patients	To determine the frequency of acute care visits and risk factors for central nervous system (CNS) events in children with homozygous sickle cell disease (SCD-SS) with an acute headache.	Headache was the chief complaint in 102 of 2685 acute care visits (3.8%) by children with SCD-SS. Acute CNS events were detected in 6.9% of these visits. Neuroimaging was performed in 42.2% of visits, and acute CNS events were identified in 16.3% of studies. Factors associated with acute CNS events included older age, history of stroke, transient ischemic attack, or seizure, neurologic symptoms, focal neurologic exam findings, and elevated platelets.	3
39. Ahad R, Kossoff EH. Secondary intracranial causes for headaches in children. Curr Pain Headache Rep. 2008; 12(5):373-378.	Review/Other-Dx	N/A	Review secondary causes of headaches due to primary brain etiologies.	Secondary headaches are caused by an underlying etiology that may be systemic (medical) or due to a problem inherent in the central nervous system. Common intracranial etiologies for headache include structural (eg, tumor, hydrocephalus, Chiari malformation), infection (encephalitis or meningitis), inflammatory (acute disseminated encephalomyelitis, multiple sclerosis, vasculitis), and epilepsy. In some situations, early identification and appropriate treatment of these underlying conditions can result in complete headache resolution.	4
40. Alperin N, Lam BL, Tain RW, et al. Evidence for altered spinal canal compliance and cerebral venous drainage in untreated idiopathic intracranial hypertension. Acta Neurochir Suppl. 2012;114:201-205.	Observational-Dx	19 women	To assess potential morphological and physiological differences between newly-diagnosed pretreated IIH patients and healthy patients.	A novel analysis of MRI measurements of blood and CSF flow to and from the cranial and spinal canal compartments employing lumped parameters modeling of the cranio-spinal biomechanics provided, for the first time, evidence for the involvement of the spinal canal compartment. The CSF space in the spinal canal is less confined by bony structures compared with the cranial CSF, thereby providing most of the craniospinal compliance.	3

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Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Study Quality
41. Dwyer CM, Prelog K, Owler BK. The role of venous sinus outflow obstruction in pediatric idiopathic intracranial hypertension. J Neurosurg Pediatr. 2013;11(2):144-149.	Observational-Dx	145 scans	To examine the role of venous sinus obstruction in the etiology of idiopathic intracranial hypertension (IIH) by reviewing more than 200 MR venograms performed in suspected cases of IIH.	Seventy-six (52%) of 145 scans showed evidence of venous obstruction in the dominant-side circulation. Substantial nonphysiological collateral circulation was seen in 68% of cases with dominant-sided obstruction, suggesting a process of recanalization. In contrast, in the absence of dominant-sided obstruction, collateral circulation was uncommon. In 27 cases, CSF opening pressure measurements were available. In 20 cases the opening pressures were in excess of 20 cm H(2)O. Of those, 17 demonstrated evidence of dominant-sided venous outflow obstruction. Among those cases, the median opening pressure was 34 cm H(2)O. Dominant-sided venous outflow obstruction was seen in only 2 of 50 MR venograms in the control group. Furthermore, evidence of collateral circulation was also uncommon in the control group. There was a highly statistically significant difference between rates of dominant-sided venous obstruction in the suspected IIH and control groups (p </= 0.001).	3
42. Rohr A, Dorner L, Stingele R, Buhl R, Alfke K, Jansen O. Reversibility of venous sinus obstruction in idiopathic intracranial hypertension. AJNR Am J Neuroradiol. 2007;28(4):656-659.	Review/Other-Dx	3 cases	To present 3 case reports in which diagnostic imaging before and after CSF diversion provided evidence that narrowing of the transverse sinuses is a secondary phenomenon.	Stent angioplasty of the venous sinuses should not be considered a therapeutic approach in these cases.	4
43. Aiken AH, Hoots JA, Saindane AM, Hudgins PA. Incidence of cerebellar tonsillar ectopia in idiopathic intracranial hypertension: a mimic of the Chiari I malformation. AJNR Am J Neuroradiol. 33(10):1901-6, 2012 Nov.	Observational-Dx	87 patients	To determine the incidence and morphology of cerebellar tonsillar ectopia in patients with IIH.	Nine of 43 patients with IIH and 1/44 controls had cerebellar tonsillar ectopia of >/=5 mm. Five of 9 of patients with IIH with ectopia of >/=5 mm also had a "peglike" tonsil configuration. Patients with IIH had a significantly lower tonsillar position (2.1 +/- 2.8 mm) than age-matched controls (0.7 +/-1.9 mm, P < .05). The obex position was significantly lower in patients with IIH versus controls (-7.9 mm [above the FM] versus -9.4 mm [above the FM], P < .05). The prepontine width was not significantly different between the groups.	2

Headache-Child
EVIDENCE TABLE

Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Study Quality
44. Agid R, Willinsky RA, Farb RI, Terbrugge KG. Life at the end of the tunnel: why emergent CT angiography should be done for patients with acute subarachnoid hemorrhage. AJNR 2008; 29(6):e45; author reply e46-47.	Review/Other-Dx	N/A	Letter responding to article by Kallmes et al on CTA in patients with SAH. The authors disagree with statement made by Kallmes et al.	The authors describe their experience with CTA as faster, safer, and cheaper (ie, better) care. Authors mention that their experience with CTA as a first-line screening technique was published recently and shows that CTA is a great tool not only for detecting aneurysms (sensitivity 98%; specificity 100%; PPV 100%; NPV 82.3%) but also to triage patients to the proper treatment method (surgical clipping vs endovascular coiling).	4
45. Kallmes DF, Layton K, Marx WF, Tong F. Death by nondiagnosis: why emergent CT angiography should not be done for patients with subarachnoid hemorrhage. AJNR. 2007; 28(10):1837-1838.	Review/Other-Dx	N/A	Editorial article on CTA in patients with SAH. Authors make a case why CTA should not be performed in SAH patients.	According to the authors, CTA does not routinely detect small arteries such as Huebner or the anterior choroidal artery. Although CTA is of limited value in a tertiary referral center, there may be reasonable uses for CTA in other practice environments.	4
46. Moran CJ. Aneurysmal subarachnoid hemorrhage: DSA versus CT angiography--is the answer available? Radiology. 2011; 258(1):15-17.	Review/Other-Dx	N/A	An editorial article comparing DSA with CTA in patients with SAH. The author questions the claim made by Westerlaan et al that CTA can be the primary imaging modality in this group of patients.	According to the author, the only acceptable modality for imaging patients with intracranial aneurysms is that which detects the aneurysm quickly, reliably, and safely and guides the prompt proper therapy. In the authors experience, conventional angiography with DSA techniques usually comes closest to that ideal.	4
47. Sabri A, Robbs JV, Maharajh J, Sikwila TC. Descriptive retrospective analysis of the diagnostic yield and morbidity of four vessel catheter-directed cerebral angiography and multidetector computed tomographic angiography (MDCTA) performed at Inkosi Albert Luthuli Central Hospital (IALCH). Eur J Radiol. 2011;80(2):498-501.	Observational-Dx	277 patients	To define the indications for and elucidate differences in the diagnostic yield, findings and morbidity between catheter directed four vessel cerebral angiography MDCTA as well as to determine whether differences exist in those individuals who underwent both imaging techniques with regard to diagnostic yield.	In our study of 277 patients carried out over an 18 month period, the most common reason of referral was subarachnoid haemorrhage followed by trauma. Aneurysms were the most common diagnosis (36%) with anterior and posterior communicating arteries being the most common locations. Fifty percent (50%) of patients investigated had a normal study.	3

Headache-Child
EVIDENCE TABLE

Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Study Quality
48. Westerlaan HE, van Dijk MJ, Jansen-van der Weide MC, et al. Intracranial aneurysms in patients with subarachnoid hemorrhage: CT angiography as a primary examination tool for diagnosis--systematic review and meta-analysis. Radiology. 2011; 258(1):134-145.	Meta-analysis	50 studies; 2 independent reviewers	To calculate the sensitivity and specificity of CTA in the diagnosis of cerebral aneurysms in patients with acute SAH at presentation.	For sensitivity, the selected studies showed moderate heterogeneity. For specificity, low heterogeneity was observed. The majority of the studies (n = 30) used a four-detector row CT scanner. The studies had good methodologic quality. Pooled sensitivity was 98% (95% CI: 97%, 99%), and pooled specificity was 100% (95% CI: 97%, 100%). Potential sources of variability among the studies were variations in the methodologic features (quality score), CT examination procedure (number of rows on the MDCT scanner), the standard of reference used, and the prevalence of ruptured intracranial aneurysms. There was evidence for publication bias, which may have led to overestimation of the diagnostic accuracy of CTA.	M
49. Mitchell P, Wilkinson ID, Hoggard N, et al. Detection of subarachnoid haemorrhage with magnetic resonance imaging. J Neurol Neurosurg Psychiatry. 2001;70(2):205-211.	Observational-Dx	41 patients	To measure the sensitivity and specificity of five MRI sequences to subarachnoid haemorrhage.	The gradient echo T2* was the most sensitive sequence, with sensitivities of 94% in the acute phase and 100% in the subacute phase. Next most sensitive was FLAIR with values of 81% and 87% for the acute and subacute phases respectively. Other sequences were considerably less sensitive.	3
50. Dubosh NM, Bellolio MF, Rabinstein AA, Edlow JA. Sensitivity of Early Brain Computed Tomography to Exclude Aneurysmal Subarachnoid Hemorrhage: A Systematic Review and Meta-Analysis. [Review]. Stroke. 47(3):750-5, 2016 Mar.	Meta-analysis	882 titles	To determine the sensitivity of brain CT using modern scanners (16-slice technology or greater) when performed within 6 hours of headache onset to exclude SAH in neurologically intact patients.	A total of 882 titles were reviewed and 5 articles met inclusion criteria, including an estimated 8907 patients. Thirteen had a missed SAH (incidence 1.46 per 1000) on brain CTs within 6 hours. Overall sensitivity of the CT was 0.987 (95% confidence intervals, 0.971-0.994) and specificity was 0.999 (95% confidence intervals, 0.993-1.0). The pooled likelihood ratio of a negative CT was 0.010 (95% confidence intervals, 0.003-0.034).	M
51. Hughes DC, Raghavan A, Mordekar SR, Griffiths PD, Connolly DJ. Role of imaging in the diagnosis of acute bacterial meningitis and its complications. Postgrad Med J. 2010;86(1018):478-485.	Review/Other-Dx	N/A	To discuss the role of imaging in the diagnosis of acute bacterial meningitis and its complications.	No results stated in abstract.	4

Headache-Child
EVIDENCE TABLE

Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Study Quality
52. Bykowski J, Kruk P, Gold JJ, Glaser CA, Sheriff H, Crawford JR. Acute pediatric encephalitis neuroimaging: single-institution series as part of the California encephalitis project. Pediatr Neurol. 2015;52(6):606-614.	Observational-Dx	141 children	To review acute neuroimaging of children with clinically suspected encephalitis to identify findings that may correlate with etiology and length of stay.	Abnormal findings were evident on 23% (22/94) of computed tomography and 50% (67/134) of magnetic resonance imaging studies in the acute setting. Twenty children with normal admission computed tomography had abnormal findings on magnetic resonance imaging performed within 2 days. Length of stay was significantly longer among children with abnormal acute magnetic resonance imaging ($P < 0.001$) and correlated with increased complexity (Spearman rho = 0.4, $P < 0.001$) categorized as: no imaging abnormality, meningeal enhancement and/or focal nonenhancing lesion, multifocal lesions, confluent lesions, and lesions plus diffusion restriction, hemorrhage, or hydrocephalus. There was no correlation between neuroimaging findings and an identifiable pathogen ($P = 0.8$).	2
53. Wasay M, Kojan S, Dai AI, Bobustuc G, Sheikh Z. Headache in Cerebral Venous Thrombosis: incidence, pattern and location in 200 consecutive patients. J Headache Pain. 2010; 11(2):137-139.	Review/Other-Dx	200 consecutive patients	Analysis of the incidence, pattern and location of headache in patients with proven diagnosis of CVT to identify an association between localization of headache and site of sinus involvement.	Headache was present in 136 (68%) patients. There was no association between headache and presence of hemorrhage on CT and MRI ($P=0.1$) or hydrocephalus ($P=0.09$). There was no association between localization of headache and site of sinus thrombosis except sigmoid sinus thrombosis, where 17/28 patients with involvement of sigmoid sinus alone or in combination with transverse sinus had pain in the occipital and neck region ($P<0.05$). There was no association between lateralization of pain and site of thrombosis ($P=0.66$).	4

Headache-Child
EVIDENCE TABLE

Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Study Quality
54. Kirk C, Nagiub G, Abu-Arafeh I. Chronic post-traumatic headache after head injury in children and adolescents. Dev Med Child Neurol. 2008; 50(6):422-425.	Review/Other-Dx	190 children admitted with head injury; data available on 117 children	Prospective, observational study of children aged 3 to 15 years admitted to hospital with head injury. Demographic data and information on the nature of the head injury, and history of premorbid headache were collected.	Head injury was minor in 93 patients and significant in the rest. Significant head injury was associated with loss of consciousness for >30 minutes, Glasgow Coma Scale of <13, and post-traumatic amnesia for >48 hours. Eight children (five males, three females; mean age 10 years 7monoths) reported chronic post-traumatic headache. Five children had episodic tension-type headache and three had migraine with or without aura. Headache resolved over 3 to 27 months in all except one child who was lost to follow-up. Premorbid headache in three children transformed in frequency and type following head injury. These patients were excluded from the study. Chronic post-traumatic headache is common after minor and significant head injury. It has the clinical features of tension-type headache and migraine and has a good prognosis.	4
55. Dayan PS, Holmes JF, Hoyle J Jr, et al. Headache in traumatic brain injuries from blunt head trauma. Pediatrics. 135(3):504-12, 2015 Mar.	Observational-Dx	12,567 patients	To determine the risk of traumatic brain injuries (TBIs) in children with headaches after minor blunt head trauma, particularly when the headaches occur without other findings suggestive of TBIs (ie, isolated headaches).	Of 27 495 eligible patients, 12 675 (46.1%) had headaches. Of the 12 567 patients who had complete data, 2462 (19.6%) had isolated headaches. ciTBIs occurred in 0 of 2462 patients (0%; 95% confidence interval [CI]: 0%-0.1%) in the isolated headache group versus 162 of 10 105 patients (1.6%; 95% CI: 1.4%-1.9%) in the nonisolated headache group (risk difference, 1.6%; 95% CI: 1.3%-1.9%). TBIs on CT occurred in 3 of 456 patients (0.7%; 95% CI: 0.1%-1.9%) in the isolated headache group versus 271 of 6089 patients (4.5%; 95% CI: 3.9%-5.0%) in the nonisolated headache group (risk difference, 3.8%; 95% CI: 2.3%-4.5%). We found no significant independent associations between the risk of ciTBI or TBI on CT with either headache severity or location.	3

Headache-Child
EVIDENCE TABLE

Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Study Quality
56. American College of Radiology. ACR Appropriateness Criteria® Radiation Dose Assessment Introduction. Available at: http://www.acr.org/~/media/ACR/Documents/AppCriteria/RadiationDoseAssessmentIntro.pdf.	Review/Other-Dx	N/A	Guidance document on exposure of patients to ionizing radiation.	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.
- M = Meta-analysis

Dx = Diagnostic

Tx = Treatment