J Headache Pain (2011) 12:13–23
DOI 10.1007/s10194-011-0297-5

REVIEW ARTICLE

Overview of diagnosis and management of paediatric headache. Part I: diagnosis

Aynur Özge · Cristiano Termine · Fabio Antonaci · Sophia Natriashvili · Vincenzo Guidetti · Çiçek Wöber-Bingöl

Received: 15 March 2010 / Accepted: 25 November 2010 / Published online: 27 February 2011

Abstract Headache is the most common somatic complaint in children and adolescents. The evaluation should include detailed history of children and adolescents completed by detailed general and neurological examinations. Moreover, the possible role of psychological factors, life events and excessively stressful lifestyle in influencing recurrent headache need to be checked. The choice of laboratory tests rests on the differential diagnosis suggested by the history, the character and temporal pattern of the headache, and the physical and neurological examinations. Subjects who have any signs or symptoms of focal/progressive neurological disturbances should be investigated by neuroimaging techniques. The electroencephalogram and other neurophysiological examinations are of limited value in the routine evaluation of headaches. In a primary headache disorder, headache itself is the illness and headache is not attributed to any other disorder (e.g. migraine, tension-type headache, cluster headache and other trigeminal autonomic cephalgias). In secondary headache disorders, headache is the symptom of identifiable structural, metabolic or other abnormality. Red flags include the first or worst headache ever in the life, recent headache onset, increasing severity or frequency, occipital location, awakening from sleep because of headache, headache occurring exclusively in the morning associated with severe vomiting and headache associated with straining. Thus, the differential diagnosis between primary and secondary headaches rests mainly on clinical criteria. A thorough evaluation of headache in children and adolescents is necessary to make the correct diagnosis and initiate treatment, bearing in mind that children with headache are more likely to experience psychosocial adversity and to grow up with an excess of both headache and other physical and psychiatric symptoms and this creates an important healthcare problem for their future life.

Keywords Headache · Childhood · Paediatric headaches · Diagnosis · Epidemiology · Defining features

On behalf of the European Headache Federation.

A. Özge
Department of Neurology,
Mersin University School of Medicine, Mersin, Turkey

C. Termine
Child Neuropsychiatry Unit, Department of Experimental Medicine, University of Insubria, Varese, Italy

F. Antonaci
University Center for Adaptive Disorders and Headache (UCADH), Unit of Pavia, Pavia, Italy

S. Natriashvili
Department of Psychiatry of Childhood and Adolescence, Medical University of Vienna, Vienna, Austria

V. Guidetti
Department of Child and Adolescent Neuropsychiatry, University La Sapienza, Rome, Italy

Ç. Wöber-Bingöl (✉)
Department of Psychiatry of Childhood and Adolescence, Medical University of Vienna, Währinger Gürtel 18–20, 1090 Vienna, Austria
e-mail: yasar.woeber-bingoel@meduniwien.ac.at

Definition

Headache is the most common somatic complaint in children and adolescents both in clinical and epidemiological databases. The incidence of childhood migraine and frequent headache has substantially increased over the last 30 years. The increased incidence is alarming and probably

reflects untoward changes in children's lifestyles. Primary headaches (especially migraine and tension-type headache, TTH) is the most important cause of headaches in this age group, but secondary headaches and unusual causes of headaches also have to be considered [1, 2].

Epidemiology of headaches

There is a high incidence, prevalence, and individual and societal cost of headache disorders in children and adolescents [3]. The reported prevalence of headache among schoolchildren varies greatly, from 5.9 to 82%, depending on the definition criteria [1, 4–6]. The vast majority of headaches is primary and classified as migraine or TTH.

Prevalence of headache increases throughout childhood reaching a peak at about 11–13 years of age in both sexes [7]. By age 3, headache occurs in 3–8% of children [8, 9]. At age 5, 19.5% have headache and by age 7, 37–51.5% have headache [10–13]. In 7–15-year-olds, headache prevalence ranges from 26 to 82% [12–14].

The studies based on parental reports may be an unreliable source of information on the frequency of headache in young children. It has been suggested that child-completed diaries and teacher observation forms should be used more widely [15]. A population-based study showed that almost 36% of the parents of children with headache are unaware of the headache [16]. Whether ID Migraine TM® is a useful tool in screening adolescent migraine is still under discussion [17].

Natural history of headache

According to several authors, longitudinal studies and repeated cross-sectional surveys are reported as essential for enhancing the knowledge about the prognostic development of pain disorders and perceived health in the younger population, and for further investigation of possible causal relationships and related factors. Recently, several clinical and epidemiological studies have been published on the long-term course of primary headaches in children and adolescents [18–27].

Natural history of migraine

Outcome research for paediatric migraine headaches is limited, thus restricting knowledge of the effectiveness of long-term management and outcome. Multidisciplinary treatment was found to be effective for children and adolescents with improvement of multiple outcome variants of paediatric migraine care, including frequency, severity, and school days missed [18].

Some important points could be summarised as follows;

- Diagnoses of primary headache subtypes change over time due to overlapping symptoms and possibly related to maturation.
- Long-term prognosis of headache is adversely affected by an initial diagnosis of migraine and by changing headache location, and it tends to be affected by an increasing time between headache onset and first presentation.
- Girls and children with frequent headache have a poorer prognosis and therefore intervention is particularly important in these groups.
- Stressful life events in childhood have an impact on the course of migraine and TTH and increase the possibility of combined headaches.
- Headache onset early in life increases the risk of an unfavourable clinical course and also genetic factors play an important role in the phenotypic expression of the disease.
- More long-term comprehensive population-based studies are needed in this area.

How to diagnose headache

A thorough evaluation of headache in children and adolescents is necessary to make the correct diagnosis and initiate treatment. The evaluation should include detailed history of children and adolescents (including parent and teacher observations, observations of child-carer, family relationships, medical history of children and parents) and completed by detailed general and neurological examinations. One has to keep in mind that some symptoms may be referred from the child's behaviour only (e.g. stopping to watch a favourite movie, interrupting a computer game, or the child's wish to go to bed in a quiet, darkened room during daytime). Children may also be asked to draw a picture of what their headache, since children, especially younger ones, communicate better through pictures than verbally [28, 29].

History

The history determines the correct diagnosis, so questions need to be directed to both the child and parents. The following questions should be included:

- Do you have one or more types of headache?
- How did the headaches begin?
- When did the headaches begin?
- Are the headaches progressive, staying the same or improving?

- How often does each headache type occur every month (or every day)?
- How long do the headaches last?
- Do the headaches occur at any special time or under any special circumstances?
- Are the headaches related to specific foods, situations, medications or activities?
- Are there warning symptoms before headache onset?
- Where is the pain located?
- What is the quality of the pain?
- Are there associated symptoms during the headaches?
- What do you do during your headaches?
- What makes the headaches better?
- Does anything make the headaches worse?
- Do symptoms continue between headaches?
- Are you being treated for or do you have any other medical problems?
- Do you take medication for any other problem on a regular on intermittent basis?
- Does anyone else in the family have headaches?
- What do you think is causing your headaches?
- How is your daily routine?

Useful strategies to help improve headache diagnosis in children might be the following:

1. Take the history with sufficient time and patience, and with age-appropriate terminology
2. Ask the patient (assisted by the parents) to keep an appropriate headache diary (e.g. depicting the main headache characteristics and associated symptoms) over a period of some weeks to document the headache frequency and duration, the degree of disability and the occurrence of associated symptoms as well as the use of medications.
3. Give yourself enough time for each patient visit. History should also include pregnancy period of mother, birth history, developmental history, injuries, operations and dietary habits of early childhood, school experiences, history of substance abuse, family relationships, socioeconomic and psychosocial status both of the child and parents.

Assessment of headache severity

Headache severity of children and adolescents should be quantified using a pain rating scale, visual analogue scale or other equivalents according to age and cognitive levels of subjects. Combined scales may be more useful than one way scales. Biological parameters of pain and observations of other family members should be noted also [30].

Physical examination

The examiners should keep in mind the tentative diagnosis and substantiate their clinical impression while performing general examination. Important clues should be noted, for example fever may indicate an infection, elevated blood pressure may indicate a hormonal or renal disturbance, growing abnormalities may indicate pituitary or hypothalamic disorders, petechia or palpable lymphadenopathies may indicate haematopoietic abnormalities, organomegaly may indicate a systemic neoplasm, atopic disorders may be related to migraine, and unexplained injuries of different ages may indicate child maltreatment [25, 31, 32].

Neurological examination

A complete neurological examination should be performed focussing particularly on level of consciousness, meningeal signs, visual disturbances, focal neurological deficits, disorders of coordination, gait and speech, auditory disorders, measurement of head circumstances, localised tenderness of scalp or any body areas. In addition, a psychiatric interview of children and parents should be performed when needed. In the majority of patients with primary headache disorders, the general physical and neurological examinations are normal [4, 33].

Psychological examination

Repeated pain experiences have some negative effects on daily living activities (i.e. sleep, appetite, play, attention, etc.). During the prepuberty and puberty period changes of emotional status and personality stand in the forefront. It should be differentiating whether the emotional problem or change is a comorbidity or the main problem. Symptoms of depression, which include sadness, tearfulness, withdrawal from activities, hopelessness, need to be checked.

It has been shown that migraine is not related to family and housing conditions, school situation, or peer relations, whereas TTH is associated with a higher rate of divorced parents and fewer peer relations [34]. As an associative comorbidity, the frequency of migraine headache in a clinic sample of Tourette syndrome subjects was nearly fourfold more than the frequency of migraines reported in the general population [35]. The evaluation process should be completed with scales (including depression, anxiety, self-esteem, CBCL, etc.) and family interview.

Laboratory tests

The choice of laboratory tests rests on the differential diagnosis suggested by the history, the character and temporal

pattern of the headache, and the physical and neurological examinations. On the contrary to migraine, detailed laboratory and imaging screen should be performed in case of migraine equivalents [36]. Subjects who have any signs or symptoms of focal/progressive neurological disturbances should be investigated by cranial computed tomography (CT) or magnetic resonance imaging (MRI) [37]. Emergency setting studies showed that neuroimaging (head CT scan or MRI) was performed on 8–41% of children, which on first glance appeared high given that 96% of all patients were ultimately diagnosed with a benign disease. However, 5.5–25% of those who underwent neuroimaging were ultimately diagnosed with a "pathological" process [38–41]. The electroencephalogram (EEG) and neurophysiological examinations (including VEP, event related potentials, EMG, etc.) are of limited value in the routine evaluation of headaches, except from "migraine-triggered seizures" [42, 43]. There are some suggestive clues about pathophysiological association between migraine attacks and epileptic seizures too [44–46]. Lumbar puncture is useful in determining the presence of infection or blood or increased intracranial pressure.

Primary and secondary headaches

As a general rule IHS classification system divides headache into primary and secondary headache disorders. In a primary headache disorder, headache itself is the illness and headache is not attributed to any other disorder. Primary headaches comprise migraine, tension-type headache, cluster headache, other autonomic cephalgias and other primary headache disorders. In secondary headache disorders, headache is the symptom of identifiable structural, metabolic or other abnormality. In the case of secondary headaches, special attention must be paid to symptoms of increased intracranial pressure and progressive neurological dysfunction. Red flags include the first or worst headache ever in the life, recent headache onset, increasing severity or frequency, occipital location, awakening from sleep because of headache, headache occurring exclusively in the morning associated with severe vomiting and headache associated with straining. Secondary headaches may occur in an acute (such as subarachnoid haemorrhage), subacute (such as meningitis) or progressive (such as neoplasms) fashion.

In children and adolescents, the abrupt onset of severe headache is most frequently caused by upper respiratory tract infection with fever, by sinusitis or by migraine. Serious conditions such as brain tumours or intracranial haemorrhages are uncommon and, when present, are usually accompanied by neurological signs such as papilledema, hemiparesis or ataxia [43].

Both epidemiological and clinical studies have shown that most common causes of headaches in children and adolescents are migraine and TTH.

Migraine

Migraine is a heterogeneous disorder: attacks vary in pain intensity, duration, pattern of associated features, and frequency of occurrence. Some migraineurs have recurrent attacks without remission periods; others experience symptom-free intervals lasting several years; a third group becomes free of attacks for the rest of their life [47].

Migraine is the second most common cause of chronic recurrent headache in school children. The prevalence ranges from 3.2 to 14.5% [4–6, 26, 47–49]. Positive family history for headache is commonly reported with a frequency of 60–77.5% [4, 22].

Over the last five decades, several definitions of paediatric migraine have been proposed. Vahlquist [50], followed by Bille [1], Prensky and Sommer [51] have been followed by IHS proposing a new set of criteria [52]. Revising the IHS headache duration criterion, i.e. decreasing minimum headache duration from 2 to 1 h, the utility of the IHS criteria for migraine performed 47–86.6% sensitivity and 92.4–98.6% specificity [53–56]. The currently accepted classification system for migraine was published by the International Headache Society in 2004 and is known as the International Classification of Headache Disorders (ICHD-II) [57].

Modification of ICHD-II criteria to include bilateral headache, headache duration of 1–72 h, and nausea and/or vomiting plus two of five other associated symptoms (photophobia, phonophobia, difficulty thinking, lightheadedness, or fatigue), in addition to the usual description of moderate to severe pain of a throbbing or pulsating nature worsening or limiting physical activity, improved sensitivity of migraine diagnosis to 84.4% [47, 58].

Balottin [25] demonstrated that the ICHD-II criteria are poorly applicable to children under the age of 6 years. Therefore, the development of alternative criteria might be useful [59, 60]. Further changes in ICHD-II criteria for paediatric migraine could stem from researches comparing the occurrence of headache in the family members and the prevalence of osmophobia in large samples of migraine and TTH patients. Both osmophobia and positive family history could thus become useful in better differentiating migraine and TTH. The prevalence of osmophobia during migraine attacks was 18.5%, and was higher in migraine patients (25.1%) than in those with TTH (8.3%). Osmophobia showed more specificity than phonophobia or photophobia in the differential diagnosis between migraine and TTH [25, 61].

Most migraine symptoms included in ICHD-II are not specific for the paediatric age groups. Among various migraine characteristics and associated disorders only type of migraine, migraine frequency, vomiting and dizziness were related to age [62]. Vomiting may help the diagnosis of migraine in young children with a familial history of migraine and dizziness is more common in children >11 years old and may aid the diagnostic process in this age group [62].

A bidirectional relationship between migraine and depression suggests a neurobiological link. Adverse experiences particularly childhood maltreatment, may alter neurobiological systems, and predispose to a multiplicity of adult chronic disorders. The majority of the studies with clinical populations show slightly higher scores on at least one of the anxiety or depression scales in the migraine group as compared to the control group. However, in all eleven studies, the average score on the anxiety and depression scales obtained by children with migraine did not reach a pathological level, according to the norms established by the validated scales. Findings point to above average levels of anxiety or depression, rather than diagnosed psychopathologies. Therefore, certain authors use the term "sub-clinical". None of the three studies carried out in the general population revealed differences between the anxiety and depression scores in children with migraine as opposed to children in the control group. The difference in results from studies in the general population and clinical populations can most likely be explained by a recruitment bias. Studies conducted with clinical populations recruit subjects from specialised medical consultations for children and adolescents with migraine, who are probably not representative of the general population. These results contradict those found in the adult population. More studies are needed to better clarify the links between anxiety, depression, and migraine in children, adolescents and adults. The association of childhood sexual abuse with migraine and depression is amplified if abuse also occurs at a later age [20, 34, 63–65].

To ensure the validity of future studies, the following remarks should be taken into account.

- The distinction between headache and migraine is not always clear, even when ICHD criteria are used.
- The children considered to have migraines often have a variety of diagnoses.
- Studies should only use the ICHD second edition criteria.
- Children suffering from migraine are usually recruited from specialised headache centres in hospitals. This is a very specific population and probably not representative of children with migraine in the general population.
- In contrast, studies including patients from specialised centres are relevant too, since they are reflecting the situation in those patients actually seen by physicians.

Migraine variants

Familial hemiplegic migraine (FHM)

FHM is an uncommon and genetically heterogeneous autosomal dominant subtype of migraine with aura in which the aura consists of hemiparesis. Three subtypes of FHM have been described: FHM1, FHM2 and FHM3. Mutations in the genes CACNA1A12 and SCNA1A13, encoding the pore-forming alpha-1 subunits of the neuronal voltage-gated Ca^{2+} channels and Na^{+} channels, are responsible for FHM1 and FHM3, respectively. Mutations in ATP1A2,14 encoding the alpha-2 subunit of the Na^{+}, K^{+} ATPase, are responsible for FHM2. The gene mutations for FHM are associated with phenotypes that show an overlap between migraine and other paroxysmal disorders [i.e. CACNA1A and episodic ataxia; SCNA1A and generalised epilepsy with febrile seizures plus (GEFS+)]. These findings provide compelling evidence for ion channels as key targets for preventive migraine treatment [66–69].

Basilar-type migraine

Basilar-type migraine is a migraine variant that is classified as part of the spectrum of migraine with aura in the ICHD-II classification. The diagnostic criteria comprise vertigo, visual disturbances in both hemifields, bilateral sensory symptoms and ataxia. The sudden appearance of diplopia, vertigo and vomiting must prompt consideration of disorders within the posterior fossa such as arteriovenous malformations, cavernous angiomas, tumours or congenital malformations [70–72].

Ophthalmoplegic migraine

Ophthalmoplegic migraine (OM) is one of the most clinically challenging migraine variants and, fortunately, one of the least common (annual incidence of 0.7 per million). It has been classified by the Headache Classification Committee of the International Headache Society (IHS) in 2004 under the heading of 'Cranial neuralgias and central causes of facial pain' [11, 15]. OM is defined as consisting of at least two episodes of headache accompanied or followed within 4 days of its onset by paresis of one or more of the third, fourth and/or sixth cranial nerves, with investigations having ruled out parasellar, orbital fissure and posterior fossa lesions. Contrast-enhanced magnetic resonance

imaging performed during symptomatic and postsymptomatic periods in patients with ophthalmoplegic migraine may hold great value in identifying the pathophysiological features of oculomotor nerve palsies. Of cases demonstrating abnormal magnetic resonance imaging, a majority show improved but persistent changes on repeat imaging [73–75].

Retinal migraine

Retinal migraine is extremely uncommon in children and usually seen in young adults. Unlike the descending curtain-like onset of amaurosis fugax, retinal migraine causes patients to experience brief (seconds to <60 min), sudden, monocular blackouts or "grayouts" or bright, blind episodes of visual disturbance before, after or during headache attacks [71, 76].

"Alice in Wonderland" syndrome

Originated from Lewis Carol's novel and characterised by bizarre visual illusions and spatial distortions which precede headaches. The children may describe bizarre or vivid visual illusions such as micropsia, macropsia, metamorphopsia and teleopsia [71].

Acute confusional migraine (ACM)

This rare type of migraine described as acute confusional states, lasting 4–24 h, associated with agitation and aphasia commonly seen in juvenile migraineurs. ACM may be a presenting feature and important clue, enabling CADASIL to be recognised. Therefore, a brain MRI and/or testing for Notch3 mutations should be considered in adult patients with ACM [77–79].

Migraine equivalents

Migraine equivalents of infancy, childhood, and adolescence are recognised periodic, paroxysmal syndromes without associated headache that are thought to be migrainous in aetiology. Following equivalents are presently recognised.

1. Cyclical vomiting (ICHD-II 1.3.1)
2. Abdominal migraine (ICHD-II 1.3.2)
3. Benign paroxysmal vertigo (ICHD-II 1.3.3)
4. Benign paroxysmal torticollis (ICHD-II A1.3.5)

Analgesic overuse may cause a worsening of non-cephalic pain in patients with extra-cephalic variants of migraine [57, 80].

Diagnosis of migraine

The diagnosis of migraine rests mainly on clinical criteria, thus a correct evaluation begins with a thorough medical history followed by a complete physical and neurological examination including examination of the optic fundus. Recently, a practice parameter that outlined guidelines for the clinical and laboratory evaluation of children and adolescents with recurrent headaches [71] stated that 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.

Tension-type headache

Although TTH and migraine are the two most common types of headache in children and adolescents, most articles address migraine headache. The smaller genetic effect on TTH than on migraine suggests that the two disorders are distinct. However, many believe that TTH and migraine represent the same pathophysiological spectrum [81].

Prevalence

TTH was reported less common in children under 10–12 years of age and more frequent in adolescents, but with reservations for methodological differences and interpretation of results, most of the epidemiological studies found that TTH was the most frequent headache in children aged 8–12 years. The prevalence of TTH in schoolchildren has been reported as 0.9–72.8% relating to study design and psychosocial events. The prevalence of TTH increases with age [5, 13, 81–83].

Diagnosis of TTH

TTH may be hard to differentiate from migraine in children as some of the symptoms overlap. Regarding the frequency of TTH ICHD-II differentiates infrequent episodic TTH occurring less than once a month, frequent episodic TTH present on up to 14 days per month and chronic TTH occurring at least on 15 days per month or 180 days per year. TTH is characterised by a bilateral pressing tightness occurring bilaterally anywhere on cranium or suboccipital region. The pain is mild to moderate in intensity and usually not aggravated by physical activity. Associated symptoms are absent or limited to one out of photophobia and phonophobia in episodic TTH and one out of mild nausea, photophobia and phonophobia in chronic TTH [57, 81].

Stressors in TTH

Anxiety and psychological stress factors are often present and headache symptoms may be triggered by additional stressful situations [84].

Underlying psychological stress factors should be evaluated. In children, a connection seems possible between TTH and psychosocial stress, psychiatric disorders, muscular stress, or oromandibular dysfunction. Childhood TTH is associated with a higher rate of divorced parents and fewer peer relations as well as an unhappy family atmosphere. In addition, children with episodic TTH were more likely to report somatic complaints and family problems than those without headache. Children and adolescents with chronic diseases and stressful family events have an increased risk for chronic TTH. Of children with chronic TTH, over 50% have had predisposing physical or emotional stress factors. Compared to migraine group, children with TTH had greater psychological and temperamental difficulties [34, 84–87]. A headache diary is a useful method for the differentiation of headache types. The diagnosis of TTH requires exclusion of secondary headaches.

Cluster headache and other trigeminal autonomic cephalgias

Cluster headache (CH), the most painful of the primary headaches is a disorder with well-known diagnostic criteria. The condition usually begins in the second decade of life; the prevalence of childhood onset is approximately 0.1% and the sex ratio is in favour of men (M:F $\sim$3.2:1), but with a wide variation of range (1:1–6:1). Onset may be as soon as 3 years, but there is a relatively low number of cases with onset <10 years old. A suspected case in a 1-year-old infant has also been described [88–90]. There are relatively few reports on the prevalence and clinical features in CH in children and adolescents, since only few population studies have also considered the paediatric population [88, 91, 92].

Paroxysmal hemicrania is a rare headache with a prevalence of 0.02%. Paroxysmal hemicrania generally begins in adulthood with onset generally after the third decade of life. Characterised by brief, unilateral attacks of intense pain around the supraorbital and temporal region, afflicted patients may have from usually 5–6 to as many as 30 attacks per day that last from 2 to 45 min. Like other trigeminal autonomic cephalgias, paroxysmal hemicrania is associated with autonomic symptoms. A key element defining paroxysmal hemicranias is their exquisite sensitivity to indomethacin. Relatively few paediatric cases have been reported in the literature. Children as young as 3 years of age have been described with the disorder [93–95].

Short-lasting unilateral neuralgiform headache attacks with conjunctival injection and tearing (SUNCT) is an extremely rare disorder in childhood with only few cases reported in the literature Unlike paroxysmal hemicrania, SUNCT syndrome is unresponsive to indomethacin, and neither oxygen nor other non-steroidal anti-inflammatory drugs provide relief [93, 96].

Chronic headache

Chronic headache is frequently seen in children and adolescents. ICHD-II provides separate definitions for the chronic forms of migraine, tension-type headache, cluster headache, paroxysmal hemicrania and several secondary headaches. In addition there are primary and secondary headaches which are chronic per se, most importantly medication overuse headache. In ICHD-II, the definition of "chronicity" is heterogeneous. In migraine, TTH or medication overuse headache, it is defined by headaches present on 15 or more days per month for at least 3 months, whereas different chronicity in CH or paroxysmal hemicrania refers to the lack of remission periods [50].

In contrast to ICHD-II, the term chronic daily headache (CDH, with or without differentiating the specific ICHD subtype) is frequently used in the literature. Being aware of this heterogeneity of definitions we did not exclude studies referring to CDH from this review. Chronic headache is estimated to occur in up to 5% of adults and is the most common headache type reported in headache clinics. In children and adolescents, chronic headache is an exceptionally challenging type of headache to treat. The most important subtypes are chronic migraine (CM), chronic tension-type headache (CTTH) and new daily persistent headache (NDPH) [97]. Chronic headache has different expressions in children and adults; the different expressions may reflect several different aetiologies or a developmental continuum. Although a positive family history predisposes children to develop headache, many environmental, biological and psychological processes may share a role in the aetiology [98, 99].

Comorbid chronic migraine and CTTH was the most frequent subtype of CDH (53%). Stressors that precipitated or contributed to the maintenance of CDH were judged important in 63% of the sufferers. Psychiatric disorders are notable in CDH (about 64% of patients) and predict (mainly anxiety) a poorer outcome. Physical abuse (10% vs. 0, $p = 0.012$) and parental divorce (17% vs. 3%, odds ratio = 5.8, $p = 0.015$) were more frequent in the CDH group. The results indicate that childhood adversities may

contribute to greater risk of the development of CDH in young adolescents [100–102].

NDPH is the least studied form of CDH. Most adolescents with NDPH do not overuse acute medication and most have prominent migraine features. Therefore, diagnostic criteria should require abrupt onset of a primary CDH of long duration as the sole requirement for NDPH diagnosis [99].

Other primary headaches

These types of headaches are very rare in childhood and adolescent practice. Some of them are responsive to adequate doses of indomethacin. Before the diagnosis of benign primary headache disorders symptomatic causes (the "crowded" posterior fossa, brain tumours, Chiari malformation, syringobulbia and vascular malformations) should be excluded [103].

Secondary headaches

Secondary headaches are also called "organic headaches" by some clinicians. These headaches can be grouped in three different ways: aetiology, symptom complex and temporal presentation [104]. Chronic headache in childhood is rarely due to serious intracranial pathology. Some of the important causes of secondary headache disorders are follows.

- Trauma
- Vascular disorders
- Hydrocephalus and neoplasms
- Substance use
- Intracranial infections
- Metabolic disorders and hypoxia
- Disorders of cranium (e.g. sinuses, eyes, etc.).
- Epileptic disorders (both of ictal epileptic headache and differential diagnosis from other benign focal idiopathic epilepsy of infancy).

Some important clues about secondary headache disorders can be summarised as follows

- Careful history-taking and thorough clinical examination will identify patients with serious underlying brain abnormalities. A change in headache symptomatology or personality should lower the threshold for imaging. However, there is no role for routine neuroimaging in the management of children with primary headache disorders [104–110].
- Headaches occurring soon after trauma frequently involve loss of consciousness, post-traumatic amnesia, or abnormal neurological symptoms and signs, post-traumatic headaches should be kept in mind.
- Minor head trauma could trigger primary headaches (especially migraine) in young children.
- Vascular disorders including vasculitis, hypertension, thrombosis, emboli, and haemorrhage, the latter being secondary to aneurysms, vascular malformations, and trauma are rare, but life-threatening causes of headaches in children and adolescents.
- In progressive headaches associated with signs of increased intracranial pressure, hydrocephalus, idiopathic intracranial hypertension and intracranial hypertension secondary to metabolic, toxic and hormonal causes should be considered.
- Intracranial tumours are the second most common type of neoplasm in children. Symptoms are often unspecific, depending not only on the localization of the tumour, but also on the age of the child. In the majority of patients, the neurological examination will be abnormal, and diagnosis should be confirmed by neuroimaging. It also should be kept in mind that non-neoplastic mass lesions may present in a similar fashion.
- In children presenting with fever, rash, lethargy, irritability, a bulging fontanel, neck stiffness, mental status changes, and/or focal neurological abnormalities intracranial infections should be kept in mind.
- Headaches are seen in patients with medication overuse and use of substances such cocaine, narcotics and amphetamines with or without associated neurological and autonomic symptoms.
- Among headache associated conscious disturbances epileptic disorders should be kept in mind.
- Compound and mixed types of astigmatism, anisometropia and miscorrection of refractive error are found more often in patients with headache than in control subjects.
- Acute sinusitis often presents with fever, rhinorrhea and tenderness over the facial area, as well as headaches. Although the 25% of patient who have been diagnosed as sinusitis previously had at least one sinusitis related complaint, this finding does not seem to be important, because 60% of the patients do not report improvement after sinusitis treatment.
- Misdiagnosis of primary headache disorders should be kept in mind.

Conclusions

- Headache in children and adolescent is a growing problem possibly related to changing lifestyle and stressors.
- Families and physicians need more knowledge about headaches in children and adolescents.

- Headache diagnosis may be more difficult in these age groups due to declaration problems and overlapping symptoms.
- In each visit of a subject with a primary headache disorders a secondary cause of headache should be kept in mind.
- Headache evaluation should be including cognitive functions and impact on daily living activities.
- Comorbidities must be considered.
- Headache diary is a mandatory tool for diagnosis and effective follow-up in patients with recurrent headaches.
- Children with headache are more likely to experience psychosocial adversity and to grow up with an excess of both headache and other physical and psychiatric symptoms and this creates an important healthcare problem for their future life.

Taking careful history from a patient presenting with headache is the prerequisite for further diagnostic and therapeutic management.

Conflict of interest None.

References

1. Bille BS (1962) Migraine in school children. A study of the incidence and short-term prognosis, and a clinical, psychological and electroencephalographic comparison between children with migraine and matched controls. Acta Paediatr 51(Supp 136):S1–S151
2. Anttila P, Metsähonkala L, Sillanpää M (2006) Long-term trends in the incidence of headache in Finnish schoolchildren. Pediatrics 117(6):1197–1201
3. Hamalainen ML, Hoppu K, Santavuori PR (1996) Pain and disability in migraine or other recurrent headache as reported by children. Eur J Neurol 3:528–532
4. Özge A, Bugdayci R, Sasmaz T, Kaleagasi H, Kurt O, Karakelle A et al (2002) The sensitivity and specificity of the case definition criteria in diagnosis of headache: a school-based epidemiological study of 5,562 children in Mersin. Cephalalgia 22:791–798
5. Karli N, Akgoz S, Zarifoglu M, Akis N, Erer S (2006) Clinical characteristics of tension-type headache and migraine in adolescents: a student-based study. Headache 46(3):399–412
6. Akyol A, Kiylioglu N, Aydin I, Erturk A, Kaya E, Telli E et al (2007) Epidemiology and clinical characteristics of migraine among school children in the Menderes region. Cephalalgia 27(7):781–787
7. Fearon P, Hotopf M (2001) Relation between headache in childhood and physical and psychiatric symptoms in adulthood: national birth cohort study. BMJ 322(7295):1145
8. Zuckerman B, Stevenson J, Bailey V (1987) Stomachaches and headaches in a community sample of preschool children. Pediatrics 79(5):677–682
9. Sillanpää M, Piekkala P, Kero P (1991) Prevalence of headache at preschool age in an unselected child population. Cephalalgia 11(5):239–242
10. Sillanpää M (1983) Changes in the prevalence of migraine and other headaches during the first seven school years. Headache 23(1):15–19
11. Lipton RB, Maytal J, Winner P (2001) Epidemiology and classification of Headache. In: Winner P, Rothner AD (eds) Headache in children and adolescents, BC Decker Inc, Hamilton, pp 87–115
12. Sillanpää M, Piekkala P (1984) Prevalence of migraine and other headaches in early puberty. Scand J Prim Health Care 2(1):27–32
13. Bugdayci R, Ozge A, Sasmaz T, Kurt AO, Kaleagasi H, Karakelle A, Tezcan H, Siva A (2005) Prevalence and factors affecting headache in Turkish schoolchildren. Pediatr Int 47(3):316–322
14. Carlsson J (1996) Prevalence of headache in schoolchildren: relation to family and school factors. Acta Paediatr 85(6):692–696
15. Lundqvist C, Clench-Aas J, Hofoss D, Bartonova A (2006) Self-reported headache in schoolchildren: parents underestimate their children's headaches. Acta Paediatr 95(8):940–946
16. Sasmaz T, Bugdayci R, Ozge A, Karakelle A, Kurt O, Kaleagasi H (2004) Are parents aware of their schoolchildren's headache? Eur J Public Health 14(4):366–368
17. Zarifoglu M, Karli N, Taskapılıoglu Ö (2008) Can ID MigraineTM be used as a screening test for adolescent migraine? Cephalalgia 28:65–71
18. Kabbouche MA, Powers SW, Vockell AL, LeCates SL, Ellinor PL, Segers A et al (2005) Outcome of a multidisciplinary approach to pediatric migraine at 1, 2, and 5 years. Headache 45:1298–1303
19. Bille B (1997) A 40-year follow-up of school children with migraine. Cephalalgia 17:488–491
20. Guidetti V, Galli F (1998) Evolution of headache in childhood and adolescence: an 8-year follow-up. Cephalalgia 18(7):449–454
21. Mazzotta G, Carboni F, Guidetti V, Sarchielli P, Feleppa M, Gallai V et al (1999) Outcome of juvenile headache in outpatients attending 23 Italian headache clinics. Italian Collaborative Study Group on Juvenile Headache (Societa Italiana Neuropsichiatria Infantile (SINPIA). Headache 39:737–746
22. Hernandez-Latorre MA, Roig M (2000) Natural history of migraine in childhood. Cephalalgia 20:573–579
23. Zebenholzer K, Wober C, Kienbacher C, Wober-Bingol C (2000) Migrainous disorder and headache of the tension-type not fulfilling the criteria: a follow-up study in children and adolescents. Cephalalgia 20:611–616
24. Galli F, Patron L, Russo PM, Bruni O, Ferini-Strambi L, Guidetti V (2004) Chronic daily headache in childhood and adolescence: clinical aspects and a 4-year follow-up. Cephalalgia 24:850–858
25. Balottin U, Termine C, Nicoli F, Quadrelli M, Ferrari-Ginevra O, Lanzi G (2005) Idiopathic headache in children under six years of age: a follow-up study. Headache 45:705–715
26. Laurell K, Larsson B, Mattsson P, Eeg-Olofsson O (2006) A 3-year follow-up of headache diagnoses and symptoms in Swedish schoolchildren. Cephalalgia 26:809–815
27. Kienbacher C, Wöber C, Zesch HE, Hafferl-Gattermayer A, Posch M, Karwautz A et al (2006) Clinical features, classification and prognosis of migraine and tension-type headache in children and adolescents: a long-term follow-up study. Cephalalgia 26(7):820–830

28. Stafstrom CE, Goldenholz SR, Dulli DA (2005) Serial headache drawings by children with migraine: correlation with clinical headache status. J Child Neurol 20(10):809–813
29. Wojaczyńska-Stanek K, Koprowski R, Wróbel Z, Gola M (2008) Headache in children's drawings. J Child Neurol 23(2):184–191
30. Cheng SF, Foster RL, Hester NO (2003) A review of factors predicting children's pain experiences. Issues Compr Pediatr Nurs 26(4):203–216
31. Forsyth R, Farrell K (1999) Headache in childhood. Pediatr Rev 20(2):39–45
32. Ozge A, Ozge C, Oztürk C, Kaleagasi H, Ozcan M, Yalçinkaya DE et al (2006) The relationship between migraine and atopic disorders-the contribution of pulmonary function tests and immunological screening. Cephalalgia 26(2):172–179
33. Metsahonkala L, Anttila P, Laimi K, Aromaa M, Helenius H, Mikkelsson M et al (2006) Extracephalic tenderness and pressure pain threshold in children with headache. Eur J Pain 10(7):581–585
34. Karwautz A, Wöber C, Lang T, Böck A, Wagner-Ennsgraber C, Vesely C et al (1999) Psychosocial factors in children and adolescents with migraine and tension-type headache: a controlled study and review of the literature. Cephalalgia 19:32–43
35. Kwak C, Vuong KD, Jankovic J (2003) Migraine headache in patients with Tourette syndrome. Arch Neurol 60(11):1595–1598
36. Al-Twaijri WA, Shevell MI (2002) Pediatric migraine equivalents: occurrence and clinical features in practice. Pediatr Neurol 26(5):365–368
37. Mazzotta G, Floridi F, Mattioni A, D'Angelo R, Gallai B (2004) The role of neuroimaging in the diagnosis of headache in childhood and adolescence: a multicentre study. Neurol Sci 25(Suppl 3):S265–S266
38. Goldstein JN, Camargo CA, Pelletier AJ, Edlow JA (2006) Headaches in United States emergency departments: demographics, work-up and frequencies of pathological diagnoses. Cephalalgia 26:684–690
39. Burton LJ, Quinn B, Pratt-Cheney JL, Pourani M (1997) Headache etiology in a pediatric emergency department. Pediatr Emerg Care 13(1):1–4
40. Kan L, Nagelberg J, Maytal J (2000) Headaches in a pediatric emergency department: etiology, imaging and treatment. Headache 40:25–29
41. Scagni P, Pagliero R (2008) Headache in an Italian pediatric emergency department. J Headache Pain 9(2):83–87 (Epub 2008 Feb 5)
42. Oelkers-Ax R, Bender S, Just U, Pfüller U, Parzer P, Resch F et al (2004) Pattern-reversal visual-evoked potentials in children with migraine and other primary headache: evidence for maturation disorder? Pain 108(3):267–275
43. Lewis DW, Qureshi F (2000) Acute headache in children and adolescents presenting to the emergency department. Headache 40(3):200–203
44. Berger M, Speckmann EJ, Pape HC, Gorji A (2008) Spreading depression enhances human neocortical excitability in vitro. Cephalalgia 28:558–562
45. Parisi P, Kasteleijn-Nolst Trenité DG, Piccioli M, Pelliccia A, Luchetti A, Buttinelli C, Villa MP (2007) A case with atypical childhood occipital epilepsy "Gastaut type": an ictal migraine manifestation with a good response to intravenous diazepam. Epilepsia 48(11):2181–2186 (Epub Aug 17)
46. Parisi P (2009) Why is migraine rarely, and not usually, the sole ictal epileptic manifestation? Seizure 18(5):309–312 (Epub 2009 Feb 15)
47. Wöber-Bingöl C, Wöber C, Karwautz A, Auterith A, Serim M, Zebenholzer K et al (2004) Clinical features of migraine: a cross-sectional study in patients aged three to sixty-nine. Cephalalgia 24(1):12–17
48. Kong CK, Cheng WW, Wong LY (2001) Epidemiology of headache in Hong Kong primary-level schoolchildren: questionnaire study. Hong Kong Med J 7(1):29–33
49. Zencir M, Ergin H, Sahiner T, Kilic I, Alkis E, Ozdel L et al (2004) Epidemiology and symptomatology of migraine among school children: Denizli urban area in Turkey. Headache 44(8):780–785
50. Vahlquist B (1955) Migraine in children. Int Arch Allergy Appl Immunol 7(4–6):348–355
51. Prensky AL, Sommer D (1979) Diagnosis and treatment of migraine in children. Neurology 29:506–510
52. Society InternationalHeadache (1988) Classification and diagnostic criteria for headache disorders, cranial neuralgia and facial pain. Cephalalgia 8(suppl 7):S1–S96
53. Wöber-Bingöl C, Wöber C, Karwautz A, Vesely C, Wagner-Ennsgraber C, Amminger GP et al (1995) Diagnosis of headache in childhood and adolescence: a study in 437 patients. Cephalalgia 15:13–21
54. Winner P, Martinez W, Mante L, Bello L (1995) Classification of pediatric migraine: proposed revisions to the IHS criteria. Headache 35:407–410
55. Maytal J, Young M, Schecter A, Lipton RB (1997) Pediatric migraine and the International Headache Society criteria. Neurology 48:602–607
56. Karli N, Akiş N, Zarifoğlu M, Akgöz S, Irgil E, Ayvacioğlu U et al (2006) Headache prevalence in adolescents aged 12 to 17: a student-based epidemiological study in Bursa. Headache 46(4):649–655
57. International Headache Society (2004) The International Classification of Headache Disorders: 2nd Edition. Cephalalgia 24, (Suppl 1)
58. Hershey AD, Winner P, Kabbouche MA, Gladstein J, Yonker M, Lewis D et al (2005) Use of the ICHD-II criteria in the diagnosis of pediatric migraine. Headache 45(10):1288–1297
59. Bordini CA, Arruda MA, Ciciarelli MC, Speciali JG (2004) Decreasing the minimal duration of the attack to 1 hour is sufficient to increase the sensitivity of the ICHD-II for migraine in childhood? J Headache Pain 5:59
60. Ruangsuwan S, Sriudomkajorn S (2007) 375 childhood primary headache: clinical features, the agreement between clinical diagnosis and diagnoses using the international classification of headache disorders in Thai children. J Med Assoc Thai 90(7):1309–1316
61. Corletto E, Dal Zotto L, Resos A, Tripoli E, Zanchin G, Bulfoni C et al (2008) Osmophobia in juvenile primary headaches. Cephalalgia 28:825–831
62. Eidlitz-Markus T, Gorali O, Haimi-Cohen Y, Zeharia A (2008) Symptoms of migraine in the paediatric population by age group. Cephalalgia 28:1259–1263
63. Tietjen GE, Brandes JL, Digre KB, Baggaley S, Martin VT, Recober A et al (2007) History of childhood maltreatment is associated with comorbid depression in women with migraine. Neurology 69(10):959–968
64. Amouroux R, Rousseau-Salvador C (2008) Anxiety and depression in children and adolescents with migraine: a review of the literature. Encephale 34(5):504–510
65. Guidetti V, Galli F (2002) Psychiatric comorbidity in chronic daily headache: pathophysiology, etiology, and diagnosis. Curr Pain Headache Rep 6(6):492–497
66. Ducros A, Denier C, Joutel A, Cecillon M, Lescoat C, Vahedi K et al (2001) The clinical spectrum of familial hemiplegic migraine associated with mutations in a neuronal calcium channel. New England 345:17–24

67. De Fusco M, Marconi R, Silvestri L, Atorino L, Rampoldi L, Morgante L et al (2003) Haploinsufficiency of ATP1A2 encoding the Na^+/K^+ pump alpha2 subunit associated with familial hemiplegic migraine type 2. Nat Genet 33:192–196
68. Vanmolkot KR, Kors EE, Hottenga JJ, Terwindt GM, Haan J, Hoefnagels WA et al (2003) Novel mutations in the Na^+, K^+-ATPase pump gene ATP1A2 associated with familial hemiplegic migraine and benign familial infantile convulsions. Ann Neurol 54:360–366
69. Thomsen LL, Kirchmann M, Bjornsson A, Stefansson H, Jensen RM, Fasquel AC et al (2007) The genetic spectrum of a population-based sample of familial hemiplegic migraine. Brain 130(Pt 2):346–356
70. Hung RM, MacGregor DL (2008) Management of pediatric migraine: current concepts and controversies. Indian J Pediatr 75(11):1139–1148
71. Lewis DW, Winner P (2001) Migraine, migraine variants, and other primary headache syndromes. In: Winner P, Rothner AD (eds) Headache in children and adolescents. BC Decker Inc, London, pp 60–86
72. Kirchmann M, Thomsen LL, Olesen J (2006) Basilar-type migraine: clinical, epidemiologic, and genetic features. Neurology 66(6):880–886
73. Woody RC, Blaw ME (1986) Ophthalmoplegic migraine in infancy. Clin Pediatr (Phila) 25(2):82–84
74. Bharucha DX, Campbell TB, Valencia I, Hardison HH, Kothare SV (2007) MRI findings in pediatric ophthalmoplegic migraine: a case report and literature review. Pediatr Neurol 37(1):59–63
75. Ravishankar K (2008) Ophthalmoplegic migraine: still a diagnostic dilemma? Curr Pain Headache Rep 12(4):285–291
76. Evans RW, Grosberg BM (2008) Retinal migraine: migraine associated with monocular visual symptoms. Headache 48(1):142–145
77. Ehyai A, Fenichel GM (1978) The natural history of acute confusional migraine. Arch Neurol 35(6):368–369
78. Jensen TS (1980) Transient global amnesia in childhood. Dev Med Child Neurol 22(5):654–658
79. Sathe S, DePeralta E, Pastores G, Kolodny EH (2009) Acute confusional migraine may be a presenting feature of CADASIL. Headache 49(4):590–596
80. Newman LC, Newman EB (2008) Rebound abdominal pain: noncephalic pain in abdominal migraine is exacerbated by medication overuse. Headache 48(6):959–961
81. Anttila P (2006) Tension-type headache in childhood and adolescence. Lancet Neurol 5(3):268–274
82. Barea LM, Tannhauser M, Rotta NT (1996) An epidemiological study of headache among children and adolescents of southern Brazil. Cephalalgia 16:545–549
83. Arruda MA, Guidetti V, Galli F, Albuquerque RC, Bigal ME (2010) Primary headaches in childhood—a population-based study. Cephalalgia 30(9):1056–1064 (Epub 2010 Mar 19)
84. Sarioglu B, Erhan E, Serdaroglu G, Doering BG, Erermis S, Tutuncuoglu S (2003) Tension-type headache in children: a clinical evaluation. Pediatr Int 45(2):186–189
85. Abu-Arafeh I (2001) Chronic tension-type headache in children and adolescents. Cephalalgia 21:830–836
86. Anttila P, Metsähonkala L, Aromaa M, Sourander A, Salminen J, Helenius H et al (2002) Determinants of tension-type headache in children. Cephalalgia 22:401–408
87. Kaynak Key FN, Donmez S, Tuzun U (2004) Epidemiological and clinical characteristics with psychosocial aspects of tension-type headache in Turkish college students. Cephalalgia 24:669–674
88. Antonaci F, Alfei E, Piazza F, De Cillis I, Balottin U (2009) Therapy-resistant cluster headache in childhood: case report and literature review. Cephalalgia 1–3, London, ISSN 0333-1024
89. Terzano MG, Manzoni GC, Maione R (1981) Cluster headache in one year old infant? Headache 21:255–256
90. Ekbom K, Ahlborg B, Schele R (1978) Prevalence of migraine and cluster headache in Swedish men of 18. Headache 18:9–19
91. Maytal J, Lipton RB, Solomon S, Shinnar S (1992) Childhood onset cluster headache. Headache 32:275–279
92. Ekbom K, Svensson DA, Traff H, Waldenlind E (2002) Age at onset and sex ratio in cluster headache: observations over three decades. Cephalalgia 22:94–100
93. Lewis D, Gozzo Y, Avner M (2005) The "other" primary headaches in children and adolescents. Pediatr Neurol 33:303–313
94. Benoliel R, Sharav Y (1998) Paroxysmal hemicrania. Oral Surg Oral Med Oral Pathol 85:285–292
95. Antonaci F, Pareja JA, Caminero AB, Sjaastad O (1998) Chronic paroxysmal hemicrania and hemicrania continua: lack of efficacy of sumatriptan. Headache 38(3):197–200
96. Matharu M, Cohen A, Boes C, Goadsby P (2003) Short-lasting unilateral neuralgiform headache with conjunctival injection and tearing: a review. Curr Pain Headache Rep 7:308–315
97. Wang SJ, Fuh JL, Juang KD, Lu SR, Hsu LC, Chen WT et al (2005) Evolution of migraine diagnoses in adolescents: a 3-year annual survey. Cephalalgia 25(5):333–338
98. McGrath PA (2001) Chronic daily headache in children and adolescents. Curr Pain Headache Rep 5(6):557–566
99. Kung E, Tepper SJ, Rapoport AM, Sheftell FD, Bigal ME (2009) New daily persistent headache in the paediatric population. Cephalalgia 29:17–22
100. Seshia SS, Phillips DF, von Baeyer CL (2008) Childhood chronic daily headache: a biopsychosocial perspective. Dev Med Child Neurol 50(7):541–545
101. Juang KD, Wang SJ, Fuh JL, Lu SR, Chen YS (2004) Association between adolescent chronic daily headache and childhood adversity: a community-based study. Cephalalgia 24(1):54–59
102. Galli F, Patron L, Russo PM, Bruni O, Ferini-Strambi L, Guidetti V (2004) Chronic daily headache in childhood and adolescence: clinical aspects and a 4-year follow-up. Cephalalgia 24(10):850–858
103. Pareja JA, Antonaci F, Vincent M (2001) The hemicrania continua diagnosis. Cephalalgia 21(10):940–946
104. Rothner AD, Hershey A (2001) Secondary headaches. In: Winner P, Rothner AD (eds) Headache in children and adolescents BC Decker Inc, London, pp 33–46
105. Abu-Arafeh I, Macleod S (2005) Serious neurological disorders in children with chronic headache. Arch Dis Child 90(9): 937–940
106. Reulecke BC, Erker CG, Fiedler BJ, Niederstadt TU, Kurlemann G (2008) Brain tumors in children: initial symptoms and their influence on the time span between symptom onset and diagnosis. J Child Neurol 23(2):178–183
107. Zimmer JA, Garg BP, Williams LS, Golomb MR (2007) Age-related variation in presenting signs of childhood arterial ischemic stroke. Pediatr Neurol 37(3):171–175
108. Distelmaier F, Sengler U, Messing-Juenger M, Assmann B, Mayatepek E, Rosenbaum T (2006) Pseudotumor cerebri as an important differential diagnosis of papilledema in children. Brain Dev 28(3):190–195
109. Akinci A, Oner O, Bozkurt OH, Guven A, Degerliyurt A, Munir K (2008) Refractive errors and ocular findings in children with intellectual disability: a controlled study. J AAPOS 12(5): 477–481
110. Senbil N, Gürer YK, Uner C, Barut Y (2008) Sinusitis in children and adolescents with chronic or recurrent headache: a case-control study. J Headache Pain 9(1):33–36