

A Review on Management of Headache Problem in Emergency Medicine Department

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Received: 16.10.2019 Revised: 17.11.2019 Accepted: 18.12.2019

Abstract

Background: One third of referrals to emergency medicine departments is occupied by patients suffering from headache. Therefore, having sufficient knowledge and capability to evaluate, diagnose and treat the disease is a mandatory option for emergency physicians/clinicians.

Objective: Due to high rate of headache incidence and thus frequent referral to emergency departments of hospitals, present study aims at reviewing the corresponding studies and related findings to make a guideline for emergency physicians and nurses.

Methodology: The authoritative online scientific databases including Pubmed, MEDLINE, Link of Springer, Online Library of Wiley, Science Direct of Elsevier, Cambridge Core, and Cochrane were searched and the useful data associated with the objective of present study were gathered, combined and then categorized in general population (including adults and pregnant ladies) and pediatric population sections, in addition to a brief explanation of headache classification.

Conclusion: Although a major part of referrals to emergency wards are for primary headache cases particularly migraine, the physicians should have the knowledge and ability to detect the secondary headache's indications and symptoms. In addition to all solutions based on drugs and medications, lifestyle changes as well as regular records of headaches will be effective among all patients suffering from headache.

Keywords: Management of headache problem, Emergency medicine, Review.

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Introduction

Conventionally, headache has been known as a frequent disease presenting to the emergency departments or neurologists. This is while substantial number of such patients are not satisfied of their diagnosis and treatment procedure [1]. Although it seems to be a simple challenge for physicians, headache may be considerably a disabling disease; hence, accurate diagnosis and treatment is valuable for both patients and physicians [2]. In addition, it has been listed in World Health Organization's list as one of the major causes of disability having a universal incidence of 47%. It is a prevalent neurological syndrome which makes 3% of adults annually refer to a general physician for primary care [3]. The prevalence of headache among males and females is different such that females are disproportionately influenced (3:1), which such a higher incidence rate provides the governments and families with a socioeconomic burden as well as productivity loss [4].

Similar to dizziness, headache is also typically a conventional presenting complaints to outpatient cares and emergency departments [5]. Additionally, most patients suffering from headache actually have migraine, and fortunately, migraine diagnosis is almost always done correctly (98%) [6]. Statistics report that headache has attracted 2.1 million visits to emergency department (ED) visits which is equal to 2.2% of all visits to ED [7]. The emergency department plays the role of hospital's heart and regular flow of tasks in this department can save life of many people. A hospital without active emergency and appropriate performance will not be able to be considered as an ideal therapeutic center. Otherwise, other medical services and wards will be affected accordingly [8]. Besides, neurologists and ED clinicians consequently are faced with plenty of headache cases and the condition is very disabling for individuals. The correct diagnosis, close empathy

and successful treatment not only provide the patient with a considerable difference, but also may be very satisfying for the clinician [1].

As a result, such visits to ED will undoubtedly be accompanied with diverse problems whose accurate management is of high importance. For this reason, present work is supposed to review management of headache problems in emergency medicine department.

Methodology

The present study is actually a qualitative work and a careful review and critical analysis of the medical literature. We undertook several searches in such authoritative online databases as Pubmed, MEDLINE, Link of Springer, Online Library of Wiley, Science Direct of Elsevier, Cambridge Core, and Cochrane. To this end, the special keywords (i.e. headache, headache classification, headache diagnosis, headache treatment, headache management, headache management in emergency department) associated with the subject of this review were determined, based on which the searches were conducted. The time range of the investigated content is limited from 2002 to 2019.

Headache Classification

The International Headache Society (IHS) releases periodically a standardized classification scheme containing general diagnostic criteria for headaches. HIS's latest update was published in 2018. Based on the categorization conducted HIS and releasing the third version of International Classification of Headache Disorders (ICHD-3), headache cases are mainly divided into three groups: primary, secondary and painful cranial neuropathies [9, 10] (Table 1).

Table 1. Classification of headache types, revised by IHS as ICDH-3 [9, 10]

Primary	Secondary	Painful cranial neuropathies
Migraine (with/without aura) Tension Type Headache (TTHs) Trigeminal Autonomic Cephalalgias (TACs)	Headaches associated with: Trauma/injury to the head or neck Cranial and/or cervical vascular disorder Non-vascular intracranial disorder Substance (drug) or its withdrawal Infection Homeostasis Disorders of the eyes, neck, cranium, nose, sinuses, mouth, teeth and to name but a few	Painful lesions of the cranial nerves and so on

Due to higher importance and prevalence of primary and secondary headache types, they are being elaborated as follows:

A. Primary Headache

According to ICHD, primary headaches are of diverse forms among which migraines, Tension Type Headaches (TTHs) as well as Trigeminal Autonomic Cephalalgias (TAC) are the most common ones. Additional forms of primary headache may be resulted from cold, exercise, cough, and in some cases, sexual activity. The fortunate news is that although nearly 98% of all headache cases are primary-type, primary headaches do not threaten the life and provide no serious and essential pathology. The primary headache is diagnosed upon exclusion of pathology and secondary headache types [11]. In the realm of epidemiology, the onset of primary headache is clearly in childhood/adolescence and the prevalence will increase with individual's growth [12]. As the most common primary headache is migraine, below is a brief description of migraine types:

Migraine without Aura: In this type of migraine, the pain is usually pulsating and unilateral. It has severe or moderate intensity. It is aggravated by physical activity and is correlated with photophobia, nausea, and phonophobia [9, 13].

Migraine with Aura: This type of migraine is specified through transitory focal neurological symptoms which are typically appeared prior to or in some cases, concurrent with the cephalalgic pain. Some patients may face a prodromal phase which is arisen some hours or days prior to beginning of headache. They may also face a post-dromal phase which is

appeared followed by the headache resolution. Symptoms of migraine with aura include: hypoactivity, repetitive yawning hyperactivity, depression, fatigue, cravings for certain foods, stiffness, pain in neck [10, 13]. The visual and sensory types of auras are proved to be the most conventional symptoms with a rate of 87.1% among both children and adults. However, in a comparison with younger children, this type of migraine is more seen [14], however, this can be attributed to inability of younger children to clearly explain the headache symptoms [15].

B. Secondary headache

Given the ICHD-3, a new headache which has begun recently and is presented along with another disorder, and is recognized to be able prompting the headache, will be permanently diagnosed as secondary headache. Because of not life-threatening diseases including upper respiratory tract infections, systemic infections and sinusitis, this type of headache has more prevalence among the pediatric population. Among low number of patients, secondary headache refers to serious life-threatening intracranial disorders including brain tumors, idiopathic intracranial hypertension, hydrocephalus, aneurysm, brain abscess/meningitis, vascular malformation, intoxication, and ventriculo-peritoneal shunt malfunction. Life threatening headache causes are seen among the patients with clinical history and physical examination which are known as "red flags" [16]. While management of acute and severe headache (secondary headaches) in ED, the initial concern will be identification of red flags (Table 2) [2].

Table 2. The cause of clinical specifications of the secondary headaches presented to ED [2]

Cause	Clinical Specifications
Vascular	
Arterial dissection (carotid or vertebral artery)	if associated stroke, focal neurological deficit and neck pain
Subarachnoid haemorrhage	thunderclap headache, nuchal rigidity, altered consciousness, likely focal neurological deficit (vasospasm, infarction), nausea/vomiting
Venous sinus thrombosis	Visual obscurations, Headache (e.g. thunderclap headache), papilloedema, seizures, focal signs, increased risk with the integrated contraceptive pill or other prothrombotic risk factors (e.g. gestation)
Ophthalmological	
Acute angle-closure glaucoma	Large oval pupil, red eye, unilateral visual disturbance
Infective	
Meningitis	Nuchal rigidity, fever/septic features, nausea/vomiting, photophobia, rash, altered awareness
Encephalitis	Confusion, focal neurological deficit, seizures in addition to above row items
Abscess	Focal neurological signs, Fever/septic features, papilloedema, altered awareness
Sinusitis/mastoiditis	Sinus tenderness, Fever/septic features, altered hearing, nasal or aural discharge
Altered cerebrospinal fluid dynamics	
Idiopathic intracranial hypertension	Usually young ladies having high Body Mass Index (BMI), papilloedema, visual obscurations/blurring, and tinnitus
Colloid cyst of the 3 rd ventricle	gait disturbance, headache, drop attacks
Low-pressure headache	Headache improved lying down which can be exacerbated by the valsalva manoeuvre
Space-occupying lesion with pressure effects	Headache (new, worsening, changed phenotype) which can be related to lateralising specifications or seizure
Inflammatory	

Giant cell arteritis	Age >50 years, weight loss, unilateral visual loss, general malaise, jaw claudication, scalp tenderness, raised erythrocyte sedimentation rate/serum C reactive protein
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Management of headache problems in emergency departments

The headache has been known as the third reason of ED visits both for children and adults [17]. Hence, the immediate actions for diagnosis of the headache type and prescribe the appropriate treatment approach are very critical and also vary among diverse cases. Proper diagnosis and treatment needs to take into account a wide differential diagnosis between primary and secondary headache types and also diverse kinds of primary headache [17]. To this end, Emergency-medicine clinical studies focus on optimization of diagnostic workups as well as treatment approaches and improvement of the outputs in an ED [18]. The general actions to be undertaken in an ED followed by a headache presentation are as follows: stabilizing the airway, breath, and circulation in sensitive patients. For the patients having a suitable general condition, the treatment will encompass just to place him in a silent and dark area to relax, because sleep is considered mostly as the most useful treatment. The comorbidities often complicate making diagnosis and therapeutic decisions, and this is while diverse primary headaches may co-exist. Having familiarity with general pediatrics, and pediatric headache disorders specifically provide the conditions to advise the patients in a better way with more expanded choices [19]. Here, we reviewed the studies and findings associated with headache problems' management in EDs from two aspects: general population and pediatric population.

A. General Population

The most conventional headache diagnoses in emergency wards include diverse benign causes as well as viral infections, migraine, sinusitis as well as post-traumatic ones [20]. Lewis and Qureshi [21] found sinusitis, viral infections and pharyngitis among more than 60% of pediatric patients with headache who had referred to emergency department of a hospital. Secondary life-threatening causes of headache, however, may attribute to high mortality and morbidity. Therefore, health staff ought to know diverse diagnoses. The following items have been found to be the most prevalent causes of non-traumatic headaches presented to emergency wards: secondary benign cases (35.4% to 63.2%), primary cases (21.8% to 66.3%), secondary life-threatening cases with the least frequency (2% to 15.3%) [22-23]. In addition, the followings are those requiring more precise attention in emergency referrals: brain tumors, ventriculo-peritoneal shunt malfunction, central nervous system infections, idiopathic intracranial hypertension, hydrocephalus and intracranial hemorrhage [24].

In contrast, in a headache case having plenty of migraine specifications, a quite negative neurological examination as well as lack of red flags may cause to send the patient to a specialized Headache Ward. In an observational study, some researchers find a decreased emergency department accessibility for recurrent headache among the patients who were prescribed to refer a specialized Headache Ward during 10 days from discharge of emergency ward [22]. The red-flags of life-threatening secondary headaches are presented in Table 3.

Table 3. The red-flags of life-threatening secondary headaches [25]:

No.	Red-flag item
1.	The new incidence of headache for patient above 50
2.	Maximum intensity during onset of headache (e.g. thunderclap headache)
3.	Posterior headache along with neck pain/stiffness
4.	Altered vision
5.	Altered consciousness
6.	Syncope
7.	Having HIV history or immunocompromised history
8.	Having malignancy history
9.	Being pregnant or in postpartum duration
10.	Having neurosurgery or cerebral shunt history
11.	Suffering from headache and seizure concurrently

Evaluation

The first notes to be taken in evaluation of a patient suffering from headache are history and physical examination which will guide a clinician to decide if more tests and imaging are required or not and if there is a considerable risk for secondary headache or not. These two items will be discussed briefly as follows [26]:

History: The history-taking incorporates a nitty-gritty record of the present headache, with exceptional consideration regarding red-flags which may reveal a risky secondary etiology (Table 3). Furthermore, the physician ought to evoke the onset, area, and nature of the migraine just as related

indications (Table 4). In case of a patient with former headache records, it is essential to investigate the contrasts between the present and earlier headaches. While most of patients with earlier essential headache present with intensifications of former headaches, unobtrusive contrasts in onset, area, and seriousness may give hints to new and risky secondary etiologies.

Table 4. The questions to be asked from patients for the purpose of headache evaluation [26]

Question	Worrying answers	Worrying for
Onset: When the headache began? What the task you were undertaking, when it began?	Sudden headache with coughing, exercise, straining and orgasm	SAH*
Provocation: What worsens the pain or makes it better? Position? Exercise? Straining?	The pain stimulated by a cough or supine position	ICP**
Quality Explain the pain and the area it is felt	Occipital headache with neurological symptoms of dysphagia, dysarthria, double vision, or ataxia	Tumor Posterior bleed Stroke
Radiation: The pain has movement or radiations?	Neck stiffness or pain with radiation down the neck	SAH Carotid Meningitis Verbal artery dissection
Severity How long did your headache take to arrive the maximum?	Thunderclap headache (maximal pain during the onset)	Venous sinus thrombosis SAH Intracranial hemorrhage
Temporal Did the pain have any changes from time to time?	Chronic and increasingly worsening headaches	Possible structural mass/lesion
Related: Do have any signs else?	Related neurological deficits, altered vision and fever	Life threatening secondary headache
* SAH: Subarachnoid Hemorrhage ** ICP: Intracranial Pressure		

Physical examination: Such an examination is fundamental to exclude life-threatening secondary headaches. An overall examination and assessment with specific accentuation on the neurologic, ophthalmologic, and head and neck assessments is suggested [26].

Diagnosis

The emergency physician/clinician cannot exclude secondary headache, if specific diagnostic studies for such headaches are presented. Conventionally, these studies encompass the followings: Magnetic Resonance Imaging (MRI) [27], Computed Tomography (CT) [28], Magnetic Resonance Venography (MRV) [29], visual acuity and intraocular pressure [30], lumbar puncture with cerebrospinal fluid analysis [31], carboxyhemoglobin [32] and erythrocyte sedimentation rate [33]. The mentioned experiments must be conducted in a selective manner to eliminate the secondary headache causes which were found to be suspected upon history-taking and physical examination [34]. Upon exclusion of secondary headaches, diagnosis of the primary headache disorder type will be of high importance. In spite of suspicious importance, emergency physicians/clinicians' capability, in a comparison with neurologists, is reported to be poor to accurately classify primary headache disorders. In order to solve it, the criteria have been developed to help providing an accurate diagnosis, though with constrained facilities [35].

Following to the trouble in precise diagnosis of explicit primary headache disorders in the emergency ward, joined with the risk of mislabeling a patient with a chronic headache condition and thus acceleration of coming anchoring bias, Singh and Soares [25] propose the emergency physician/clinicians to not classify their patients based on the certain primary headache types; the physician are recommended to believe such a fact a patient lacks a life-threatening secondary headache and simply diagnose the disorder as a primary headache, preventing mislabeling and accepting the correct diagnosis of primary headache disorders (according to recommendation of ICHD-3) [20].

Treatment

Followed by inherent misclassification of headaches in research and the conventional pain pathways in emergency wards for migraine, a major part of the literature on migraine treatment could be summed up by primary headache disorders [25]. In this sub-section, evidences of primary headaches certain treatments will be elaborated. Accordingly, the drugs and medications to be prescribed as well as the related dosing for primary headache are given in Table 5, according to American Academy of Neurology (AAN/US) Headache Consortium guidelines. The table includes AAN Quality of evidence, as well [36].

Table 5. Medications and dosing to be prescribed for primary headache [36]

Drug	Dosing (mg)	Quality of Evidence
Aspirin	1000 by mouth	A
Ibuprofen	400-600 by mouth	A
Ketorolac	15-30 intravenous	B
Naproxen	500-825 by mouth	B
Acetaminophen	900-1000 by mouth	B
Dihydroergotamine IV	0.5-1 intravenous	B
Aspirin/ Acetaminophen/ Caffeine	500/500/130 by mouth	A
Chlorpromazine	0.1 intravenous	B/C
Metoclopramide	20 intravenous	B
Prochlorprazine	10 intravenous	B
Sumatriptan SQ	6 subcutaneous	A
Sumatriptan PO	6 by mouth	A
Opioids	Variable	B
Dexamethasone	6-10 by mouth/ intravenous	C

With several investigations looking at different drugs and dosages and also various definitions, details, and torment scales, it tends to challenge for the emergency physician/clinician to figure evidence-based therapies for all primary headache types. Whereas society rules help, they are frequently composed from the vantage purpose of the senior staff in clinic and may not mirror the handy idea of emergency management and treatment [25].

According to [37], in emergency wards, the physicians underdiagnose migraines, so that they underuse triptans, and considerably trust in opioid medications as primary therapy for headaches. Based on such factors, Singh and Soares [25] invited a simple treatment pathway for primary headaches. This pathway is evidence-based and is consistent with the corresponding guidelines and also it will be no way difficult to administer (Figure 1).

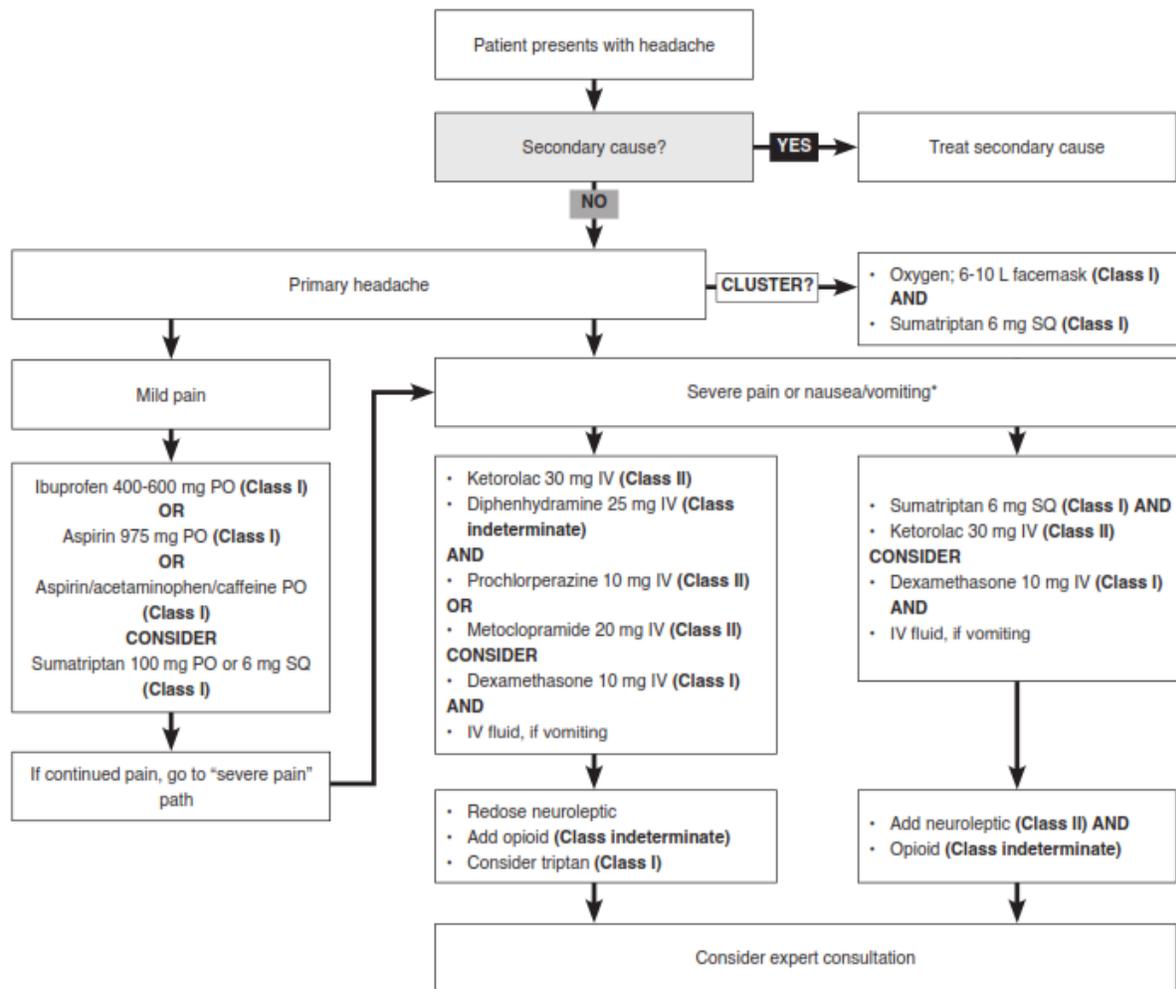


Figure 1. Primary Headache Treatment's Clinical Pathway

According to Figure 1, the patients suffering from mild primary headache are recommended to be treated with oral

medications (i.e. Aspirin or Aspirin/Acetaminophen/Caffeine). For the patients having no contraindications or those taken

triptans previously, it is recommended to prescribe sumatriptan 6 mg (subcutaneous) or 100 mg (by mouth). Instead, if considerable nausea or vomiting is seen and intravenous is hard to be accessed, then such drugs as ketorolac, phenothiazines, diphenhydramine, and opiates can be taken [25].

Besides, those suffering from severe headache and without contraindications are recommended to be treated by sumatriptan 6 mg (subcutaneous) and a Nonsteroidal Anti-Inflammatory Drug (NSAID). Instead, an intravenous should be commenced and the patient is given a neuroleptic (typically, prochlorperazine 10mg joined with diphenhydramine 25 mg or metoclopramide 20 mg) along with ketorolac 15 to 30 mg (intravenous). If the pain is not alleviated, the physician is recommended to prescribe sumatriptan, redoes the prior neuroleptic, and add an opioid. In this pathway, the patients in emergency ward should receive by 5 medications (all intravenous) plus intravenous fluid hydration. In case of suffering from severe headache: hydromorphone 1 mg, ketorolac 15 to 30 mg, prochlorperazine 10 mg with diphenhydramine 25 mg, and dexamethasone 10 mg. Finally, after 2 rounds of aggressive pain management, in case of no improvement in patient's headache, the clinician is recommended to take alternative diagnoses into consideration and address this issue with a specialty consultation or hospital admission [25].

Emergency headache management for pregnant women

The headache's intensity and frequency decrease among pregnant women. However, particular attention and useful treatment choices should be paid to the pregnant women suffering from headache. The elevations of estrogen and progesterone are assumed to provide a protective effect versus tension-type headaches and migraine. In addition, ovarian hormones seem to modulate neurotransmitters in the trigeminal nerve's shared headache pain pathway. Multiple prospective and retrospective studies of migraine headaches reveal an improvement rate of up to 89.5% [38].

Upon diagnosis of primary headache for a pregnant women, then the clinician ought to determine a safe and useful therapy. It should be noted that, a non-pharmacological treatment should permanently be considered during the pregnancy. However, a pregnant suffering from primary headache may experience depression, stress, poor nutritional intake and sleep deprivation, thus, providing adverse effects for both baby and mother. As a result, considering benefits and probable risks, if non-pharmacological solutions look insufficient, then taking drugs will be a reasonable option [39]. As a principle, the solution with the least effective dosage and the lowest period of treatment is supposed to be chosen. In doing so, a list of recommended drugs for elimination of primary headaches among pregnant women is presented in [38].

B. Pediatric population

The headache prevalence varies among children given their age, such that 3 years old children occupy 3-8% and 5 and 7 years old ones compose 19.5% and 37-51.5%, respectively. Interestingly, males and females have higher frequency of headache cases before and after puberty, respectively [40]. The next crucial point is that a rate of 35% of children suffering from headache at least once a year refer to an emergency ward, in comparison to a rate of 17% of general pediatric populations [41]. Also, a far higher rate of hospitalization is assigned to children with any kind of headaches (5.1% annually), in a comparison with those without headaches (1.7% annually) [42]. Besides, the pediatric headaches presented to emergency wards report secondary benign headaches as the most conventional type, which is associated with either infections of acute upper respiratory tract or a primary headache syndrome [17].

Evaluation

As in general population, for evaluation of headache among a pediatric population referred to an emergency ward, history-taking and physical examination are necessary because they are considered as reliable indicators to detect headaches leading to life-threatening conditions.

History: A least possible precise history is needed for an accurate diagnosis, thus, asking the right questions from both children and their parents is of high importance. The emergency physician/clinician should ask questions regarding the headache details including onset, duration, quality, and pain severity. In addition to mentioned details, some questions about triggers and exacerbating factors including stress and sleep pattern changes as well as alleviating factors warning signs and should be asked [43]. A detailed list of what to be asked from children suffering from headache and referred to an emergency ward can be found in [17]. For this purpose, contents of Table 4 can be useful, as well. In addition, such factors as household and family dynamics, psychosocial stress factors as well as school performance are recommended be taken into consideration, since they can be underlying factors among a pediatric population. Accordingly, a screen called HEADSS which stands for Home, Education, Alcohol, Drugs, Smoking, and Sex needs to be undertaken among all adolescent patients [44].

Physical examination: Physical examination is highly important and should be completely carried out. Assessment of the patient's pain severity is the initial step, indicating a more serious basic condition [44]; then, investigation of the headache suffering children's clinical specifications in emergency ward presenting as the chief complaint and finally, their observational study should contain a report that all patients suffering from life-threatening secondary headache may experience a very intensive pain. Additionally, the important clues should also be investigated which will result in a correct diagnosis (i.e. petechiae, skin rash, organomegaly, stiff neck). Changed vital signs (specifically, blood pressure and body temperature) are indicatives of serious conditions [45]. While valuation of a child suffering from headache, it will be necessary to undertake a perfect neurological examination in order to identify intracranial lesion signs. These items must be paid into attention in particular: meningeal signs, the level of consciousness, visual disturbances, disorders of gait and coordination, speech and hearing disorders, focal neurological deficits, and localized changed sensitivity of the scalp or other areas of the body. The head circumference will be helpful to be evaluated among younger children. Furthermore, through investigation of investigating of visual signs (e.g. unequal pupils) and sinus tenderness, the head and neck must be inspected and palpated, as well. Besides, in order to check the possible signs of a neurocutaneous syndrome, the skin should also be investigated, particularly tuberous sclerosis and neurofibromatosis, indicating intracranial neoplasms [46]. As the last but not least, if necessary, a psychiatric evaluation is recommended to be undertaken for children and parents. In most of patients suffering from primary headache disorders, it will be normal to conduct both general physical examination and neurological examination [47].

Diagnosis

Plus physical examination, diagnosis should be undertaken for some special cases. The few children requiring more evaluation should be guided in terms of work-up through the basic cause suspected. There are different types of diagnostic tests for children, including cerebrospinal fluid (CSF) examination, routine laboratory analysis, and neuroimaging with CT or MRI. In addition, children presenting with a Central Nervous System (CNS) history and an abnormal neurological examination are recommended to be investigated by routine neuroimaging [17]. For the purpose of diagnosis, we will review three conventional ways as follows:

Fundoscopy Examination: For children suffering from headache, an ophthalmologist consultation is often demanded by emergency clinicians in order to exclude papilledema (i.e. optic disc swelling) [48]. The papilledema may indicate an increase in intracranial pressure and the experts believe that it will develop following to the headache onset. A meta-analysis conducted on about 400 pediatric patients suffering from brain tumors found papilledema among merely 13% of such patients [49]. Segev-Becker et al. [50] conducted an analysis on 479 children suffering from headache in an emergency ward for investigation of papilledema. In their study, six children (3.5%) only had papilledema (four patients had IIH, one patient had meningococcal meningitis, and one of them missed follow-up). In addition, medulloblastoma was also diagnosed in a patient experienced by normal fundoscopic examination. They also revealed that routine evaluation of ocular fundus in an emergency ward will not be useful, particularly if the symptoms onset is in less than 24 hours. Nevertheless, fundus examination is commonly believed to be included in the neurological evaluation of a child suffering from headache, even not permanently leading to exclusion of life-threatening secondary conditions [17].

Neuroimaging: Due to being fast and easy to perform, Computed Tomography (CT) is the basic neuroimaging measure which is undertaken in an emergency ward for patients suspected in secondary headache. The modern CT machines which are used for children employ low-dose radiation systems, thus in an emergency case, they represent the first-instance examination. In addition, although Magnetic Resonance Imaging (MRI) delivers high-quality images, its cost will be higher and those younger than 6 may require sedation or anesthesia for MRI [51]. The neuroimaging means must be booked for the children who have either abnormal findings regarding neurological examination or a suspicious clinical history or other symptoms which indicate intracranial space-occupying lesions [52]. As a result, prior to making decision regarding neuroimaging, it will be necessary to utilize all data about age at headache onset, onset type (i.e. abrupt or gradual), severity, frequency, having an aura or not, and also undertaking a comprehensive clinical and neurological evaluation. In an emergency ward specific for children, it is required to characterize the headache for identification of the child who may benefit from neuroimaging. Meanwhile, identification of the children will be necessary, who are able to do in absence of neuroradiological investigations. This is done to prevent subjecting them in useless and even potentially sometimes harmful procedures [46]. For infants and toddlers, the followings indicate intracranial mass: increased head circumference, cranial sutures disjunction and constant scalp veins. Among the children in later ages, headache or diplopia represent the most frequent disorders. The following are proved to indicate brainstem herniation: abnormal inspirations, bradycardia, and arterial hypertension; it is noteworthy to mention that such signs need urgent neuroimaging [23]. It should be also noted that the children with an age below 5 yet show more challenges in an emergency ward for a neurologist or pediatrician, because for such children, headache might be considered as the only sign. However, in an investigation with 364 children (in an age group of 2-5) suffering from headache, it was shown that the CT scans' diagnostic outcome was low among children without any worrying records and having shown a normal neurological examination [23]. If a suspicious clinical history or abnormal neurological examination is seen, it is recommended to conduct imaging. For imaging purpose, although MRI is preferred, CT scan with no contrast agent will be acceptable as a routine procedure in an emergency ward, due to its availability and rapidity [23]. The headache type determines headache suffering children's appropriate neuroimaging.

Choosing the most accurate sequence is a crucial way to undertake the most proper route for arriving an etiological diagnosis through maximization of imaging yield and minimized risk for children [53]. Some emergency wards prefer CTA over MRI, however, in case of indicated vascular imaging, consideration of both techniques is recommended [17].

Laboratory Tests, electroencephalogram (EEG), Lumbar Puncture (LP), and Neurophysiological Examinations: For headaches evaluation, laboratory tests are proved to not be very useful [45]. However, such tests have been employed to reveal the fact that the most prevalent secondary headache type among the pediatric populations referred to an emergency ward children is attributed to infections of upper respiratory tract [45]. On the other hand, Lumbar Puncture (LP) should not be routinely used for pediatric headache evaluation, but it is recommended to be undertaken among those having either suspected intracranial infection or subarachnoid hemorrhage or high pressure headaches (IIH) [17]. Finally, electroencephalogram and neurophysiological examinations (i.e. evoked cortical potentials) are also not recommended to be routinely employed for the diagnosis of children suffering from headache in an emergency ward [54]. Therefore, emergency clinicians should specify which group of patients require neuroimaging in an emergency ward. Besides, a plenty number of patients have no access to care services or their access is so limited, complicating more the decision making process in clinical cases.

Treatment

After diagnosis, the accurate treatment actions should be undertaken. Blume [55] reports three main groups of headache treatment in a pediatric emergency ward which are as follows: lifestyle changes, complementary therapies and abortive therapy. Accordingly, a diverse group of lifestyle, physical and complementary interventions indicated through the following solutions: Sleeping sufficiently and properly, Meals in regular and healthy manner, proper Activity which is not excessive and deficient, Relaxation methods, Recognition and to avoid Triggers (SMART). However, most of them are proved to have poor empirical evidence in terms of efficacy [19]. Besides, nausea, phonophobia, and photophobia are the symptoms to be reduced by any treatment approach in an emergency ward. Also, because acute medications will show their highest effectiveness when pain is mild yet. To this end, the pediatric patients and their parents are recommended to ensure about availability of the medications [56]. Nevertheless, prescribing oral drugs will be difficult for acute head pain, nausea or chronic headache exacerbation, and/or vomiting [19]. Therefore, since vomiting is known as a crucial part of the migraine attacks among young children, beginning intravenous rehydration and antiemetic drugs administration will be the first priority for emergency clinicians. In case of impossibility to prescribe medications by mouth, intravenous solutions are recommended to be taken into account in a pediatric emergency case [57, 58]. Similarly, additional medications including ergot derivatives such as dihydroergotamine as well as triptans such as serotonin 1b/1d receptor agonists have been proven to be efficient for children. Moreover, US Food and Drug Administration (FDA) have labeled 4 types of triptan for treatment of acute migraine among 12-17 aged teenagers: oral almotriptan, nasal spray zolmitriptan, oral rizatriptan, and oral sumatriptan/naproxen. FDA has also recommended rizatriptan (melt) for 6-11 aged children [17]. Raucci et al., [17] invented a clinical pathway for children suffering from headache in an emergency ward (Figure 2). This pathway can be used to guide the emergency clinicians/physician in clinical practice.

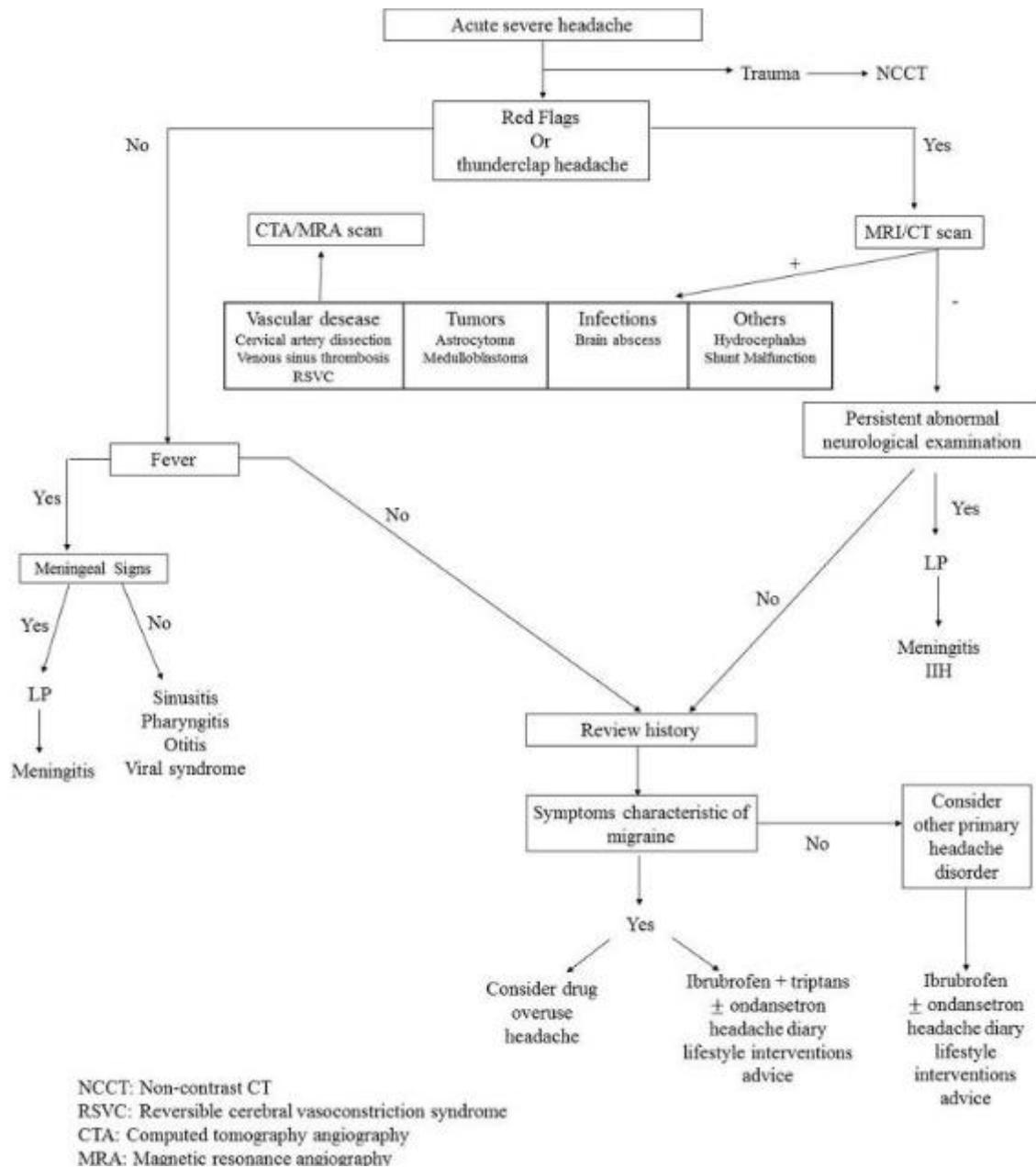


Figure 2. A clinical pathway for children suffering from headache in an emergency ward

Conclusion

In emergency wards, patients suffering from headaches are conventional to be visited. The emergency physician is mainly in charge of excluding life-threatening secondary causes of headache. However, in spite of presence of headache specific diagnostic criteria, they usually show no acceptable performance in an emergency setting and wrongly consider the patient having chronic headache. Upon diagnosis of primary headache, the emergency physician will look for a safe and useful solution to alleviate the pain. Although a major part of referrals to emergency wards are for primary headache cases particularly migraine, the physician should have the knowledge and ability to detect the secondary headache's indications and symptoms.

As in adults, a stepwise method for evaluation, diagnosis and treatment of pediatric headaches is necessary in order to prevent missing secondary headaches, making decisions quickly on diagnosis and thus treatment. For evaluation, a

comprehensive history-taking and physical examination own the first priority, in addition to paying a special attention to the red-flags and abnormalities relevant to secondary headache types. For diagnosis, neuroimaging including CT, MRV and MRI are recommended for positive outcomes resulted from on neurological evaluation and the cases where no worries exist regarding life-threatening secondary cause of headaches. On the other hand, Lumbar Puncture (LP) is recommended to be undertaken for suspected meningitis and high pressure headache (IHH). In case of not meeting the criteria of ICHD-3 for primary headache, it will be necessary to conduct more investigations. For treatment, the acute episode is recommended to be treated immediately based-on evidence based drugs and medicines. In case of suspicious migraine, it is recommended to prescribe NSAIDs and triptans. In the event of vomiting and nausea, antiemetic medicines and intravenous rehydration are recommended to be prescribed. Disregarding

all drugs and medications, lifestyle changes as well as regular records of headaches will be effective among all patients suffering from headache.

Acknowledgment

We thanks to School of Medicine, Shahid Beheshti University of Medical Sciences, Tehran, Iran

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