

Algorithm-based approach to headache

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ABSTRACT

One of the most commonly encountered scenarios in any healthcare setting is a patient presenting with a headache. Yet, the assessment, diagnosis and treatment of headache disorders can be challenging and burdensome for even specialist doctors in medicine, psychiatry, oto-rhinology, neurology and so on. Apart from saving patient's and doctor's time as well as money, this article will buy leading time for better outcome and management of certain difficult headache disorders. The aim of this review is to simplify the approach to headache diagnosis for an early and proper referral. Literature search was done on PubMed and Google Scholar using key words. Only studies which were in English were considered. Sixty-one articles published from 1975 to 2022 were reviewed after screening for inclusion and exclusion criteria. It is very essential that a primary care physician is aware of the classification of headache. Red flag signs of high-risk headaches are essential for proper referral. It is also essential that we rule out secondary headaches as they are more life threatening. Vulnerable populations such as geriatric and paediatric populations require expert attention in case of headache disorders.

Keywords: Cluster, headache, migraine, primary care, tension type, treatment

Introduction

Headache may be described as a disabling and painful characteristic of primary headache disorders that include cluster headache (CH), tension-type headache (TTH), migraine and chronic daily headache syndromes.^[1] The World Health Organization (WHO) has reported that in any given year, nearly one-half of the adult population in the world will suffer from a headache disorder. This shows it has a tremendous effect on 'public health'.^[2] It is a common universal symptom that has varied and complex causes.^[3] The Ad Hoc Committee on Classification of Headache has classified headache into as many as 15 categories.^[4] The second edition of the International Classification of Headache Disorders (ICHD-2) has classified headache disorders depending on aetiology into primary and secondary headaches. Primary headache disorders are without

any underlying aetiology and secondary headache disorders may be due to specific causes [Table 1].^[5] Headaches can be seen in people irrespective of their races, socio-economic status and age. However, it is more commonly prevalent in the female sex.^[3]

One of the most commonly encountered scenarios in any healthcare setting is a patient presenting with a headache. Yet, the assessment, diagnosis and treatment of headache disorders can be challenging and burdensome for even specialist doctors in medicine, psychiatry, oto-rhinology, neurology and so on. The sole purpose of this review is to simplify the approach to headache diagnosis for an early and proper referral. Apart from saving patient's and doctor's time as well as money, this article will buy leading time for better outcome and management of certain difficult headache disorders.

Materials and Methods

Literature search (eligibility criteria, information sources and search): A complete literature search was done to identify population-based research work on different types of headache and their management. PubMed and Google Scholar were used to search

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the following key words: primary care, migraine, headache, treatment, cluster, tension type. Most articles were published from 1970 to 2022, and only English language was considered. Only online articles were included in the review.

Data extraction (data collection process): The information extracted included the types of headache, their prevalence, their classification, diagnosis and management. Also, information about diagnosis and management of various types of headache in special populations based on age group was also included.

Study selection

All studies published from 1975 to 2022 that were available online were selected. Out of 80 articles screened, 61 were included. Studies which were in language other than English were excluded, and those that did not have access were also excluded. Only those articles in which headache diagnosis was according to the International Classification of Headache Disorders-1 (ICHD-1) or ICHD-2 or ICHD-3 were included. Although ICHD-1 appeared in 1988, we also included studies on headache prevalence before 1988.

Data items

Population: We selected studies that were performed in a sample representative of the whole population. We also included studies on special populations such as geriatric and paediatric age groups. Studies based on specific populations such as clinic population/college students/pregnant women were not included.

Intervention: Studies describing various types of pharmacotherapy for headache, including oral medications as well as parenteral medication of primary headache particularly, were included. Studies exploring neurostimulation methods for treatment of primary headache were included. All articles describing acute as well as prophylactic management of primary headache were included.

Comparison or control: May be or may not be present.

Outcome: Reduction of headache.

Study design: Systematic reviews, meta-analysis, randomised controlled trials (RCTs) as well as other narrative reviews were included. Case series and case reports were not included.

Epidemiology and Classification

Primary chronic daily headache syndrome has been divided into chronic TTH, migraine, new daily persistent headache (NDPH) and hemicranias continua (HC). They comprise almost 98% of all headache disorders.^[6] Although secondary headaches are more serious and can end up in life-threatening scenarios, most of the time, headaches are treatable with lifestyle changes and/or medications.^[3]

ICHD third edition (beta version)

Primary headaches

Although primary headache disorders are not life threatening, they are responsible for high disability-adjusted life years (DALY) and morbidity. The true magnitude of public health burden of headache has not been fully acknowledged until now. Headache causes huge loss to society indirectly through loss of work time. Like any other chronic disorder, headaches cause loss of quality of life, disability and morbidity at an individual level.^[7] DALY due to primary headaches can be reduced by early identification [Figure 1] and swift evidenced-based management [Table 2].

On the other hand, secondary headaches are mostly acute and subacute, life threatening and tagged with mortality. The doctor in medicine outpatient department (OPD) or a resident in casualty/ community health centre (CHC)/ first referral uni (FRU) needs to be quick and rational while evaluating a case of headache, and it is essential that a detailed clinical examination is done to rule out secondary headaches. (a) Neurogenic headache is acute, abrupt and holocranial, associated with infection/head trauma, rigidity of the neck, localising signs, vomiting and so on. (b) Ear, nose and throat (ENT) headaches are associated with vertigo, giddiness, otalgia, sinusitis and rhinitis. (c) Ophthalmological headaches are associated with signs and symptoms of glaucoma and refractive errors. (d) Psychogenic headaches are mostly caused by sleep disturbance, untreated mood disorders/psychotic disorders, as well as substance withdrawal syndrome [Figure 2].

Secondary headaches require specialist consultation [Figure 1]. In neurogenic secondary headache, investigations such as computed tomography (CT) scan, magnetic resonance imaging (MRI) and so on are done to rule out haemorrhages/infarct/space-occupying lesions (SOLs)/any other neurological abnormality. In ENT headaches, speculum examination, otoscopy, nasal endoscopy, CT scan para-nasal sinuses (PNS) and so on are performed. Ophthalmological headaches

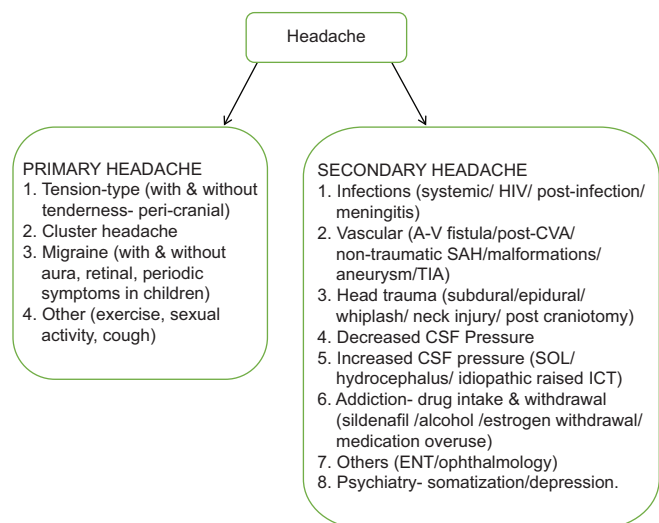


Figure 1: Classification of headache (based on aetiology)

require slit-lamp examination, refractory error examination, fundoscopy, ophthalmoscopy and so on [Table 1]. Psychogenic headaches can be diagnosed with detailed clinical history and Mental Status Examination (MSE).

High-Risk Headaches or Dangerous Headaches

It is difficult to distinguish high-risk headaches from benign ones because there are overlapping signs and symptoms.^[8] The high-risk headaches are associated with certain red flag symptoms that are mostly established by consensus reports and observational studies. Thus, they may not be unequivocally precise in determining the severe underlying aetiologies among patients with headache. Hence, patients showing features of secondary headaches should be examined and investigated thoroughly to rule out any high-risk pathology. Various radiological examinations are available to make this task easier, such as CT scan and MRI. MRI is much more sensitive in identifying smaller lesions.^[9]

Childhood Headache

In one study, it was found that 24%–90% of children present with headache as a symptom and the total prevalence is about 58.4% among children.^[33] Among the school-going children, prevalence is equivalent in girls and boys,^[33] rises with age in both genders and the surge is more in females than males during adolescence. The most common primary headache among children is none other than migraine.^[34] Its prevalence in childhood is around 7.7%; however, it is underdiagnosed among children.^[33] Cluster headaches as well as paroxysmal hemicranias, which are trigeminal autonomic cephalgias, are rare among children.^[34] TTH is also seen in children with a prevalence of 5%–25%, and the age on onset is equivalent to 7 years. It may be precipitated by various psychosocial stressors as well as comorbid psychiatric disorders such as anxiety and mood illnesses.^[35] In the paediatric group, secondary headaches occur mostly due to acute infections such as sinusitis, upper respiratory tract infection (RTI), systemic infections and so on. In a few cases, they may be due to chronic intracranial illnesses such as

Table 1: Differential diagnosis of secondary headache

Diagnosis	Symptoms	Signs	Investigation
Cervicogenic headache ^[7]	Non-throbbing headache, starting in the neck Duration- varied	Precipitated by movement, reduced range of neck movement, neck/shoulder/arm pain- ipsilateral, no side shift	X-ray
Giant cell arteritis ^[7,14]	Age at onset >50 years Onset- abrupt unilateral/bilateral headache, scalp tenderness, visual symptoms- diplopia, blurred vision/loss, limb claudication, constitutional symptoms- fever, malaise, fatigue, weight loss	Tender, thickened, reduced pulsation in superficial temporal artery, scalp tenderness, visual field defect, vascular bruit	ESR >50 mm/h Arterial biopsy- vasculitis characterised by mononuclear cell infiltration, multinucleated giant cells Fundoscopy Optic disc- pale and swollen with haemorrhage
Idiopathic intracranial hypertension ^[14]	Daily, non-pulsating, diffuse headache increased by coughing, straining	Papilloedema, visual field defect, enlarged blind spot, sixth nerve palsy	LP-CSF pressure >200 mm of H ₂ O (non-obese) >250 mm of H ₂ O (obese) MRI, CT
Post-traumatic headache ^[14]	Headache except any typical features within 7 days after head trauma		CT with bone window images X-ray- fracture, ligamentous injury of spine, subluxation Cranial MRI- focal contusion- non-haemorrhagic
Subarachnoid haemorrhage ^[15]	Intense, incapacitating abrupt-onset headache associated with vomiting	Neck rigidity, altered mentation	CT scan- haemorrhage MRI CSF examination if scan is normal Angiography
Central venous thrombosis ^[15]	Headache with no specific features	Seizure, signs of raised intracranial tension, focal neurological signs	MRI along with MRV venous thrombosis
Trigeminal neuralgia ^[16]	Unilateral, onset- abrupt, electric shock-like sensations, duration- seconds to 2 min, along distribution of the fifth cranial nerve (second, third divisions), pain induced by washing, brushing, smoking, talking	Neurological deficit- absent	MRI- vascular/non-vascular Compression of fifth cranial nerve
Acute glaucoma	Painful red eye, sudden blindness/blurred vision	Clouding of cornea, conjunctival injection, visual disturbances	Elevated IOP>28 mmHg
Acute sinusitis	Frontal headache, pain in ear, face and teeth	Sinus tenderness	Elevated ESR, polymorphonuclear leucocytosis Pus culture- organism isolated X-ray- shadow/fluid level

CSF=cerebrospinal fluid, CT=computed tomography, ESR=erythrocyte sedimentation rate, IOP=intraocular pressure, MRI=magnetic resonance imaging, LP-CSF=Lumbar puncture-cerebro-spinal fluid, MRV=Magnetic resonance venography

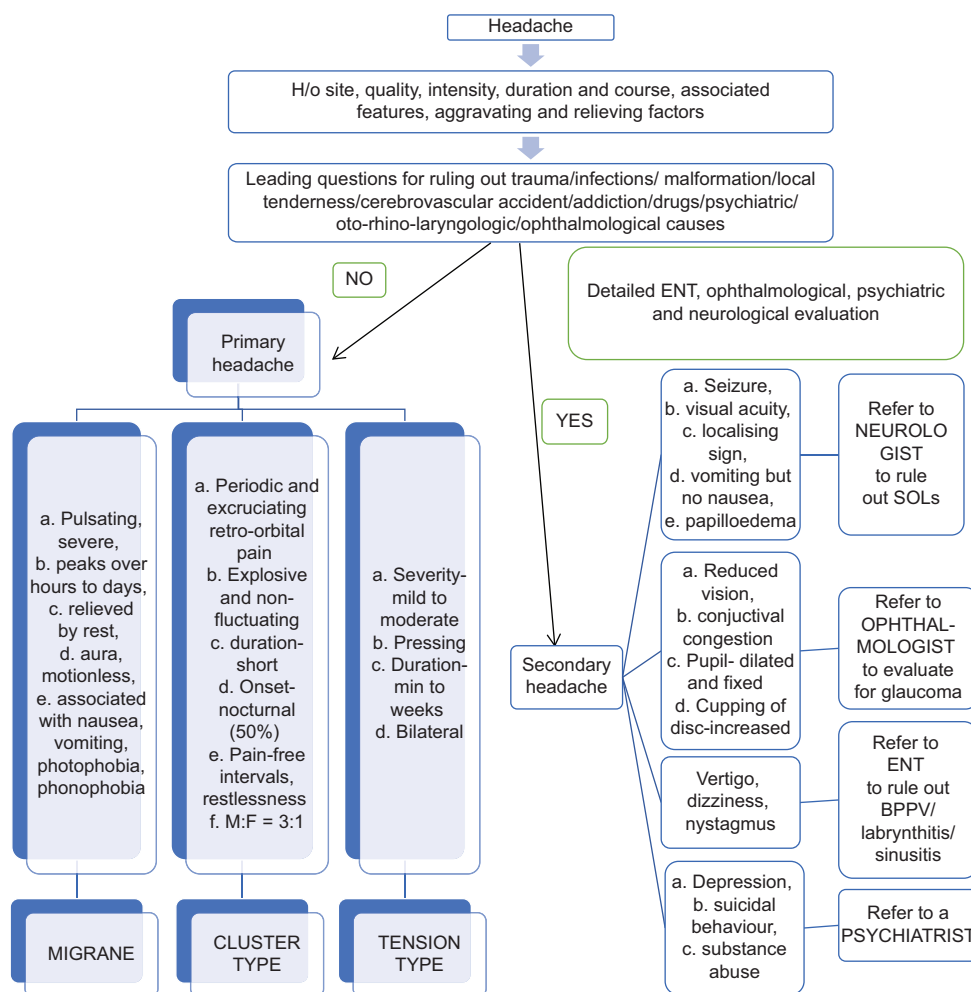


Figure 2: Approach to a case of headache^[10-13], BPPV: Benign paroxysmal positional vertigo

meningitis, encephalitis, brain abscess, brain tumours, SOLs, idiopathic intracranial hypertension, hydrocephalus, vascular malformations and others.^[36,37] It has also been seen that unhealthy lifestyles lead to increased incidence of childhood headache, for example, high parental expectations, increased academic pressure, overinvolvement in extracurricular activities, increased screen time, cut-throat competitions, poor nutrition and reduced sleep.^[38] Red flags and the approach to headache evaluation among children are similar to those of the adult population.

Management of Childhood Headache

Non-pharmacological management

The child is advised to stay in a dark and quiet room in order to rest. Sleep and hydration often help.^[35] SMART is an acronym which consists of various lifestyle modifications that can help in the management of childhood headache.

Pharmacological management

First-line acute pharmacological treatment of primary headaches, especially TTH, among children involves

nonsteroidal anti-inflammatory drugs (NSAIDs) such as paracetamol and/or ibuprofen adjusted to paediatric doses.^[39] For acute management of migraine with and without aura among children, triptans can be given along with NSAIDs. For nausea and vomiting, domperidone, prochlorperazine and cyclizine may be added.^[40] For trigeminal autonomic cephalgias (TACS), high-flow oxygen at 12 L/min has been recommended.^[39] Prophylactic management of primary headaches is more or less same in children as in adults.

Headache in Geriatric Age Group

The prevalence of headache in older population is around 12%–50%.^[41,42] Headache among elderly population is mainly due to primary headache such as migraine and TTH. However, the risk of secondary headache increases among elderly.^[42,43] The risk of dangerous or high-risk headache rises 10 times among those aged 65 years and above.^[42] It has been observed that secondary aetiologies such as vascular events cause sudden deaths among elderly, especially intracranial haemorrhage, rupture of aneurysm and cervical arterial dissection. In the presence of red flag signs, investigations among elderly population may vary and they should comprise various blood

Table 2: Management of primary headaches

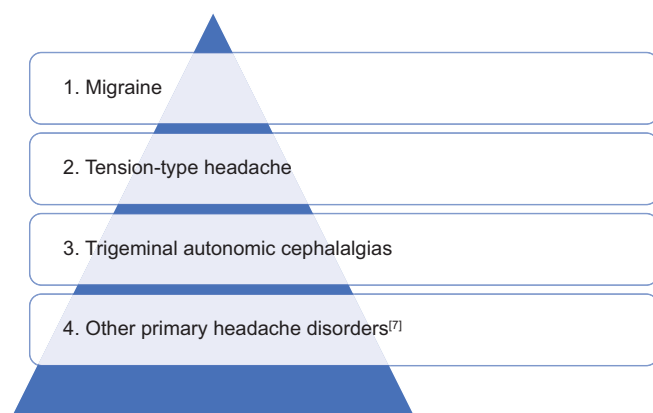
Type of primary headache	Treatment available
Migraine	First-line pharmacotherapy ^[18-23]
Acute treatment	Combination of analgesics: aspirin (250 mg)/caffeine (65 mg)/acetaminophen (250 mg) Combine triptans and NSAIDs: naproxen (500 mg)/sumatriptan (85 mg) (maximum dose: two tablets/day) Triptans Almotriptan, rizatriptan, eletriptan, frovatriptan, sumatriptan, naratriptan, zolmitriptan NSAIDs: Naproxen (250-500 mg orally 12 hourly, maximum dose- 1 g/day) Ibuprofen (200-800 mg orally 6-8 hourly, maximum dose- 2.4 g/day) Other effective pharmacotherapies ^[18-23] Ergotamines: dihydroergotamine Acetaminophen (325 mg)/isometheptene (65 mg)/dichloralphenazone (100 mg) Antiemetics: metoclopramide, prochlorperazine Dexamethasone IV Lidocaine IV 5-HT _{1F} agonist, lasmiditan ^[24] Calcitonin gene-related peptides such as rimegepant or ubrogepant ^[24]
Preventive treatment ^[17]	Injectable ^[17] Subcutaneous sumatriptan Neurostimulation ^[17] TMS. VNS External trigeminal nerve stimulation Oral and intranasal ARBs: lisinopril, candesartan Beta-blockers: propranolol, metoprolol, timolol, atenolol, nadolol CCBs: “flunarizine “ Anticonvulsants: topiramate, valproate Antidepressants: Tricyclics: amitriptyline SNRI: venlafaxine Nutraceuticals: “riboflavin, coenzyme Q10, magnesium, omega3, vit-D ^[25] Injectables CGRP pathway monoclonal antibodies Onabotulinumtoxin-A Neurostimulation External trigeminal nerve stimulation Occipital nerve stimulation High cervical spinal cord stimulation Transcranial magnetic stimulation
Tension-type headache	Level A recommendation ^[28]
Acute treatment ^[26,27]	Ibuprofen 200-800 Ketoprofen 25 mg Aspirin 500-1000 mg Naproxen 375-550 mg Diclofenac 12.5-100 mg Paracetamol 1000 mg (oral) Level B recommendation ^[28] Caffeine comb. 65-200 mg
Prophylactic treatment ^[26]	First line Amitriptyline. 30-75 mg Second line Mirtazapine.30 mg Venlafaxine.150 mg Third line Clomipramine 75-150 mg Maprotiline 75 mg Mianserine 30-60 mg

Contd...

Table 2: Contd...

Type of primary headache	Treatment available
Non-pharmacological treatment ^[26]	Psycho-behavioural treatments: EMG biofeedback Relaxation training Cognitive-behavioural therapy
Cluster headache Acute treatment ^[29-31]	Triptans Sumatriptan S/C (6 mg) Zolmitriptan nasal spray. (5 and 10 mg) Sumatriptan nasal spray. (20 mg) Zolmitriptan. orally (10 mg) Oxygen High-flow mask (flow rate of 12-15 L/min, sitting position) Lidocaine nasal spray ipsilateral nostril at 4% and 10%
Prophylactic treatment ^[29-31]	Verapamil 360 and 560 mg/day, increased to up to 960 mg/day Lithium 0.6 and 0.8 mmol/L Topiramate 100 and 200 mg/day (monotherapy or add on to verapamil) Prednisolone Triptans- frovatriptan, or naratriptan Melatonin Calcitonin gene-related peptide monoclonal antibodies ^[32] Suboccipital blockade- greater occipital nerve with a mixture of lidocaine and a steroid (i.e. dexamethasone) Non-invasive vagus nerve stimulation Spheno-palatine ganglion micro stimulator

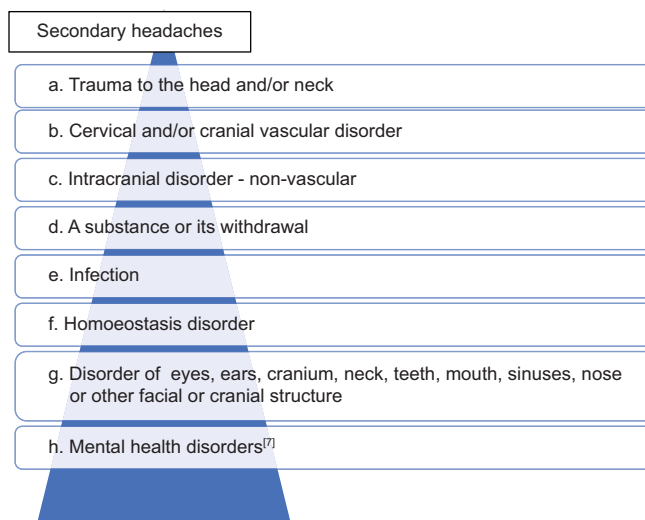
ARBs=angiotensin pathway blockers, CCBs=calcium channel blockers, EMG=electromyography, IV=intravenous, NSAIDs=nonsteroidal anti-inflammatory drugs, TMS=transcranial magnetic stimulation, VNS=vagal nerve stimulation, SNRI=Serotonin and norepinephrine reuptake inhibitors, CGRP=Calcitonin gene related peptide



Primary headache

tests including erythrocyte sedimentation rate (ESR) and neuroimaging techniques to rule out vascular anomalies or tumours/SOLs.^[44] Most importantly, chronic disorders such as hypertension and type 2 diabetes mellitus should also be ruled out.

Once secondary headache disorders are ruled out, primary headache may be diagnosed.^[44] Among those aged above 55 years, the 1-year prevalence was found out to be 35.8% in a review article.^[45] It has been observed that there is higher risk of TTH among patients with depression, overuse of pain medication, as well as chronic pain and frequent headaches.^[45] Among older adults, migraine is the second most common headache and the 1-year prevalence is around 10%.^[43,46] Treatment of primary headache among older adults is similar to that of younger adults.



Secondary headache

Discussion

The approach of a doctor should be to get a thorough history of headache, which consists of the type, site, intensity and frequency, aggravating and relieving factors, course, duration and other associated characteristics. With available information, the next step is to ask leading questions in order to differentiate primary and secondary headache [Figures 1 and 2]. Arriving at a conclusion is very essential to plan further management [Table 2] or referral. Following guidelines helps to save time and avert confusion. A case of secondary headache may require further neurology/ophthalmology/ENT/psychiatric consultation depending on the history and

Red flag symptoms of high-risk headaches:^[9,47-51]

- Headache is the worst one in the patient's life
- Neck stiffness or meningismus
- Certain focal neurological signs (excluding typical aura)
- Age >50 years
- Rapid-onset headache due to rigorous exercise
- New onset of severe headache during pregnancy/postpartum
- Papilloedema
- Temporal artery tenderness
- Worsening pattern
- Rapid/sudden onset (thunderclap headache, peak in intensity within seconds or minutes)
- Headache associated with systemic disease (fever, rash)
- Headache precipitated by exertion/cough/sexual intercourse
- Headache associated with altered personality/mental status/level of consciousness
- New headache type in a patient with cancer, Lyme disease, HIV infection
HIV = human immunodeficiency virus

Red flag symptoms of high risk headaches

'Medication overuse headache (MOH) in elderly'

Defined as headache that occurs more than or equal to 15 days/month due to overuse of medication^[52]

Certain non-analgesics also cause MOH, such as nifedipine, dipyridamole, nitroglycerine, proton-pump inhibitors and SSRIs^[53,54] Medication overuse was responsible for 19% of chronic TTH as well as 31% of chronic migraine^[55]

What can be done? Analgesic medications used for various pains should be prescribed only for limited time in order to prevent MOH^[56] It is essential to be vigilant about MOH in case of poly-pharmacy as well as deranged pharmacokinetics due to altered liver and/or renal function among older adults.^[44]

Medication overuse headache

examination [Table 1]. It is equally important that we identify the red flag signs and do the needful.

Limitations

This review only includes the studies written in English language; so, several data are not included due to language constraint. Also, only reports available online are included in the study. Management of secondary headache could not be discussed in detail.

Conclusion

Algorithm-based approach to a disease is a classic concept. However, ours is an attempt to streamline the procedure that a patient has to follow through to get a proper treatment and referral, which is usually not done meticulously. We have also looked into headache in extreme age groups such as in geriatric and paediatric populations and how they are different from normal adults. This is one step in the direction of clinical and practical management of headache disorders. There is still room left for further improvement and modification.

List of abbreviations

DALY = disability-adjusted life years
TTH = tension-type headache
CH = cluster headache

Non-pharmacological management of childhood headache

SMART stands for
S- sufficient Sleep,
M- healthy Meals,
A- optimum Activity,
R- proper Relaxation and
T- avoiding Triggers^[40]

^aTriggers include excess caffeine, chocolate, nitrite, alcohol-containing food and monosodium glutamate (MSG) from their diet, screen time

Non-pharmacological management of childhood headache

Peculiarities of primary headache in elderly

Elderly migraine:

The characteristic features change as the patient gets older Symptoms such as phonophobia, photophobia, nausea and vomiting decrease, but rhinorrhoea and lacrimation increase.^[57,58] Neck pain is more common among older adults, and if the migraine is of late onset, aura without headache occurs more commonly^[58]

Hypnic headache:

A primary headache type described as a headache disorder that occurs for short duration mostly in older population >50 years of age As they occur during sleep, they awaken the person and in order to be diagnosed as hypnic headaches, they must occur for ≥15 days per month^[52]

More common in females and in the age group ≥60 years^[59,60]

Headache in elderly

NDPH = new daily persistent headache

HC = hemicranias continua

PHC = primary health care

CHC = community health centre

SOLs = space-occupying lesions

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Conflicts of interest

There are no conflicts of interest.

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