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Review Article

Psychiatry/Mental Health Section

Unraveling the Mysteries of Exploding Head Syndrome: A Narrative Review

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ABSTRACT

Exploding Head Syndrome (EHS) is a rare parasomnia characterised by the perception of loud, abrupt auditory hallucinations during sleep-wake transitions. Even though EHS is not associated with any physical pathology, it may cause substantial sleep disturbances and interruptions. To address these questions, the present narrative review synthesises the current knowledge and consensus on the nature of EHS, including its symptoms and possible causes, existing classification systems, and available interventions. Other frequent complaints include rhythmic noises in the ears, difficulty seeing and somatic sensations, such as electrical buzzing in the head. Stress or anxiety may potentially precede an episode, and dysfunction in the brainstem reticular formation and mild temporal lobe seizures have been suggested as possible neurological causes. EHS falls under the category of parasomnias within the International Classification of Sleep Disorders Third edition (ICSD-3) and is classified as an unspecified sleep-wake disorder under the Diagnostic and Statistical Manual of Mental Disorders Fifth edition (DSM-5). Current intervention strategies are still scarce; while topiramate has been shown to lessen the intensity of symptoms, no trials on this possibility have been conducted so far. Education and reassurance may be useful in alleviating these symptoms. More studies are required to increase knowledge about the underlying processes and to establish specific therapeutic strategies. The present review alerts readers to the growing evidence for EHS, which remains a condition that is not frequently identified, and urges investigators to conduct randomised controlled therapeutic trials.

Keywords: Auditory hallucinations, Parasomnias, Psychological stress, Temporal lobe seizures, Sleep disorders, Sleep-wake transition

INTRODUCTION

The EHS is a sleep disorder characterised by loud, brief auditory hallucinations that a person experiences either before going to sleep or right after [1,2]. Although it usually happens infrequently, the loudness may be unnerving; however, it poses no significant health risk. It's possible for someone to see a flash of light [2,3]. Usually, there is no pain. Investigated but ruled out as potential organic reasons are certain genetic mutations, temporal lobe seizures, ear issues and nerve malfunctions [4]. Psychological stress is one of the possible risk factors. It falls within the category of headache or sleep disorders [5]. People frequently lack a diagnosis. It seems that women are more likely to be impacted [6]. The ailment was first documented in 1876, at the latest [7]. In 1988, the current name EHS was adopted [8]. The auditory hallucinations have a varying pattern [9].

Sounds are described as thunder, blasts, gunshots, electrical sounds, and the like, but they do not correspond to any external aural sensations [2]. Most of them are not associated with pain or bodily harm. The principal manifestation of EHS is the feeling of a loud bang or explosive pressure in the head. Patients may also see spots of light or experience a shock, like a lightning bolt [3]. The episodes are short, generally lasting only a few seconds. They can be completely shocking and may result in moments of confusion or slight panic; however, there is no physical threat involved [3]. It is possible for these episodes to occur occasionally, rather than continuously, although the frequency may vary [1,3]. Often, other symptoms occur simultaneously, which may include an increased heart rate, panic, or difficulty returning to sleep [8].

The EHS typically starts in adulthood, but it may develop at any age [1]. In some cases, symptoms are repeated over a short period and then subside; in other cases, it is chronic, occurring sporadically for years [9]. While some people might suffer several episodes each night, others may experience infrequent ones. According to the course of the disorder, the number of episodes may increase or decrease, and some patients may experience spontaneous remission of symptoms [1,9]. EHS does not progress to other more severe neurological conditions, and it is generally non progressive, although complaints about it can cause distress to the sufferer [5,8,10].

There can be a number of causes or triggers for the onset or aggravation of EHS episodes. Insomnia or lack of sleep is on the list of well-known catalysts [5,11]. Other factors include stress, anxiety and high levels of fatigue that are known to worsen the condition [4]. Furthermore, certain medications, especially those acting on the central nervous system, may play a role in episodes [5,9,11]. For instance, drugs taken to manage depression or anxiety conditions may have recommendations concerning EHS among people. Caffeine and alcohol consumed in the evening, before going to bed, could also be potential triggers for episodes [10].

Most adult patients with EHS show spontaneous improvement and do not need hospitalisation. However, due to the relationship between sleep hygiene and episodes, one can avoid experiencing so many [5]. Good sleep hygiene entails arising at the same time each day, developing a preslumber ritual, and avoiding substances that contain caffeine, as well as, brightly lit screens [5,10]. Other measures to help prevent episodes include practicing stress-busting techniques such as meditation, mindfulness and deep breathing [9]. Cognitive Behavioural Therapy (CBT) may be helpful for more severe cases, such as sleep-related anxiety issues, when inpatient settings are not possible [6,8].

Search Methodology

Using a methodical approach, the present narrative study on EHS searched PubMed and important databases like StatPearls using a variety of keywords such as 'exploding head', 'auditory hallucination', 'sleep disorders', 'sleep-wake transition', 'parasomnias', 'temporal lobe seizures', and 'psychological stress'. The rejection criteria ensured credibility, whereas the inclusion criteria focused on papers providing significant insights into EHS. The search was conducted using a variety of sources, including expert opinions and clinical trials, and it covered articles published up to 2024. Peer-reviewed

research was given priority in the quality assessment, and proven findings were cross-referenced. The approach aimed to provide an up-to-date and thorough overview of EHS, covering symptoms, causes, classification and available treatments.

DISCUSSION

An unusual sleep condition known as EHS is characterised by an explosive sensation in the head that occurs during the transition from sleep to wakefulness [10]. Although the attacks are usually harmless, if they occur frequently, the panic they induce might cause sleeplessness and heightened wakefulness [11]. The etiology of EHS is still unknown, and it is believed that brain activity during the transition from wakefulness to sleep is somehow disturbed [8]. Some dysfunction or lesion in the reticular formation, which is responsible for the sleep-wake cycle, can lead to the perception of loud auditory sounds due to malfunctioning neurons firing [6,11]. Temporal lobe abnormalities, which play a role in auditory processing, might also explain the development of these symptoms [4]. Hormonal fluctuations, stress and sleep deprivation are recognised as potential precipitating factors, as might alterations in neurotransmitter levels of serotonin [1,10]. A hereditary factor may also be involved, as certain cases indicate a genetic background [4].

Diverse Dimensions of Exploding Head Syndrome (EHS)

Many EHS sufferers also report experiencing visual abnormalities, such as seeing flashes of light, lightning, or visual static [12]. These individuals have strong, often frightened emotional reactions to loud imagined noises they hear or perceive when going to sleep or waking up, yet they do not report any severe pain [2,13]. Before the audio hallucinations begin, some patients may also feel hot, experience peculiar sensations in their torsos, or have electrical tingling in their heads [10,14]. Individuals who are highly aroused may feel distressed, confused, and exhibit myoclonic jerks, tachycardia, perspiration, and a sensation of not breathing at all, which requires them to remind themselves to start breathing again [15,16]. Some individuals describe experiencing two to four episodes in total, followed by a prolonged or complete remission [17,18]. Others report experiencing attacks over a period of weeks or months until the episodes resolve on their own [19]. Yet others note irregular recurrence of the attacks on a daily, weekly, or monthly basis throughout a significant portion of their lives [18]. The symptoms of EHS are listed in [Table/Fig-1].

Symptoms	Description
Visual disturbances	Observing lightning, static, or light bursts
Auditory hallucinations	Loud imagined noises during sleep or wakefulness, strong emotional reactions
Somatosensory sensations	Heat, torso sensations, electrical tingling in head
Autonomic symptoms	Arousal, distress, confusion, myoclonic jerks, tachycardia, sweating, feeling of not breathing
Episode frequency	Two or four episodes, followed by remission
Attack duration	Several weeks or months before spontaneous cessation
Recurrence pattern	Irregular attacks every few days, weeks, or months throughout life

[Table/Fig-1]: Symptoms of Exploding Head Syndrome (EHS).

Epidemiology of EHS

The EHS has not been clearly described in terms of its epidemiology, although statistically adjusted figures claim that approximately 10-15% of people are affected by this disorder at some point in their lives [1,10,15]. A more conservative estimate is 6-13%, and it may be even slightly higher among the specific subpopulation with sleep disorders [1,15,17]. Epidemiological studies of EHS in India, as in other parts of the world, are scarce because the problem is not well researched, and people seldom report their condition to medical practitioners. Still, considering data from a global level, it is assumed that the same rates apply in India [1,15]. The distribution of EHS in the demographic picture is possible for all the mentioned age groups; however, its prevalence is slightly higher among the middle-aged and elderly populations [12,15,18,19]. Evidence shows that it occurs more frequently in females than in males [15]. Although EHS can occur in childhood, it is comparatively less common in the paediatric group [1].

Understanding Exploding Head Syndrome (EHS) Causes

There is no recognised cause of EHS. Many theories have been proposed, the most popular of which is that the brainstem's reticular formation, which is responsible for the transition between waking and sleeping, is dysfunctional [17,20]. Mild temporal lobe seizures, hearing impairments, such as sudden modifications to the Eustachian tube or middle ear structures, or a rupture of the membranous labyrinth or labyrinthine fistula, as well as, anxiety and stress, can cause EHS [21,22]. EHS may be triggered by temporary calcium channel malfunction or antidepressant discontinuation syndrome [23]. Additionally, EHS can be caused by post-traumatic stress disorder [12,24]. Hypnic jerks and troublesome spontaneous orgasms during sleep might accompany EHS [16,25]. Abnormal attentional processing in patients with EHS may lead to exaggeration and manipulation of external sensory cues during the sleep-wake transition [26,27]. Potential causes of EHS are presented in [Table/Fig-2] [12,17,20-26].

Potential causes	Description
Brainstem reticular formation dysfunction [17,20].	Dysfunction in the area responsible for sleep-wake transition
Temporal lobe seizures (mild) [21,22].	Seizures originating in the temporal lobe of the brain
Hearing impairments [21,22].	Sudden changes in middle ear structures, Eustachian tube, or inner ear structures
Anxiety and stress [22]	Psychological factors that can trigger EHS episodes
Temporary calcium channel malfunction [23]	Disruption in the way calcium channels function in the brain
Antidepressant discontinuation syndrome [23]	Withdrawal symptoms from stopping antidepressant medication
PTSD [12,24]	A mental health condition that can manifest as EHS
Hypnic jerks and spontaneous orgasms [25]	Involuntary movements and sexual arousal during sleep, potentially associated with EHS
Abnormal attentional processing [26]	Altered processing of sensory cues during sleep-wake transition in EHS patients

[Table/Fig-2]: Potential causes of Exploding Head Syndrome (EHS) [12,17,20-26].
EHS: Exploding head syndrome; PTSD: Post-traumatic stress disorder

Placement of EHS in Sleep Disorder Classifications

The peculiarity of this type of auditory hallucination is that individuals who experience it are not fully conscious [28,29]. The 2014 International Classification of Sleep Disorders (ICSD, 3rd Edition) categorises explosive head syndrome under various parasomnias [28,30]. International Classification of Diseases, Tenth Revision (ICD-10) and DSM-5 classify EHS as either an other specified sleep-wake disorder (codes: 780.59 or G47.9) or as an unspecified sleep-wake disorder (code: G47.8) [31,32]. The classification of EHS in diagnostic manuals is shown in [Table/Fig-3] [30-32].

Diagnostic manual	Classification	Code(s)
ICSD-3 [30]	Other parasomnias	N/A
ICD-10 [31]	Either other specified sleep-wake disorder	780.59 or G47.9
DSM-5 [32]	Unspecified sleep-wake disorder	G47.8

[Table/Fig-3]: Exploding Head Syndrome (EHS) classification in diagnostic manuals [30-32].
ICSD-3: International Classification of Sleep Disorders, 3rd edition; ICD-10: International Classification of Diseases, 10th revision; DSM-5: Diagnostic and Statistical Manual of Mental Disorders, 5th edition

Diagnostic Criteria for EHS

Although there are no specific diagnostic criteria for EHS, the diagnosis and assessment of the patient are primarily clinical, based on the patient's self-report of symptoms [21]. As defined in the current International Classification of Sleep Disorders-Third edition (ICSD-3), the following features should be present in order to diagnose EHS [30]. First, the person should have atleast two episodes of a sudden loud noise or a sense of an explosion occurring in the head [30]. Sometimes, this sensation is also described as a sharp, sudden onset of head pain, which literally seems to come out of the blue. Furthermore, these episodes are most frequently observed during transitions between sleep stages, with the majority occurring during the periods of falling asleep or waking up [1,22]. They are not observed while in a fully awake state. Another important consideration is the lack of any tangible symptom that could explain the feeling. The levels of noise or the explosion that the person experiences should not be related to any other pathology, such as seizures, headaches, psychiatric disorders, or linked to substance abuse [1,22].

These episodes are certainly startling, and the feelings that often coincide with the sensation of hair standing on end are typically ones of fear or anxiety; however, there is generally no significant acute pain experienced in conjunction with the sensation [4]. It is non invasive, and complications are usually limited to momentary confusion or discomfort [1,2]. Lastly, the episodes start and end quickly, lasting mostly only seconds, and do not cause any neurological or psychological aftereffects [1]. After the episode is completed, the individual's condition typically returns to baseline, free of such symptoms [1,4].

Testing for Diagnosis of EHS

The EHS has no specific diagnostic tests; therefore, diagnosis relies on the description provided by the patient. However, additional tests may be recommended to eliminate other possible causes of similar symptoms. One such test is polysomnography, or a sleep study, which might be suggested in cases of suspected sleep disorders [5,11,28]. Polysomnography records brain electrical activity during sleep, along with eye movements and other physiological parameters, in order to eliminate potentially other disorders, such as sleep apnoea or seizures, which may be associated with EHS but are not directly diagnostic of it [5,28].

Sometimes, an Electroencephalogram (EEG) may be performed, particularly when there are unusual neurological features, to exclude epileptic activity [11]. Moreover, the patient may be advised to undergo Magnetic Resonance Imaging (MRI), Computed Tomography (CT) scans, or other imaging investigations to rule out neurological disorders with symptoms similar to those caused by tumours, aneurysms, or any structural anomalies [11,21,27]. However, these tests help to eliminate other possibilities of symptoms similar to EHS but do not confirm EHS itself.

Treatment Insights and Future Directions for EHS

One possible treatment for EHS is topiramate, which can lessen the severity of symptoms [33]. Topiramate can reduce the signs of a loud buzz and bang in the EHS sleep pattern [33]. EHS management with topiramate is related to antagonistic actions on P-type calcium channels. The primary method of treatment was found to be related to the reduction of the loud noise levels experienced by the patients during treatment with topiramate [33]. Based on a hypothesis derived from the patient's family history and migraines, EHS could involve a transient dysfunction of calcium channels, similar to genetic diseases such as Familial Hemiplegic Migraine (FHM) related to the Calcium voltage-gated Channel subunit Alpha1 A (CACNA1A) gene [33]. This maternally-inherited gene is expressed in Lysosomal Associated Membrane Protein 1\+ (LAMP1\+) cells and codes for the α1A subunit of the neuronal P/Q-type Voltage-gated Calcium Channels (VGCCs), a calcium channel critical to neuronal excitability [33].

It is well documented that topiramate affects P-type calcium channels, and this is likely to influence the pathophysiological changes in electrical activity occurring during the transition from wakefulness to sleep that might be implicated in EHS [33]. Topiramate presumably decreases neuronal hyperexcitability by stabilising calcium channels, which may explain why the intensity of the auditory events in patients can decrease from a bang to a buzz [33].

No clinical trials had been conducted as of 2024 to ascertain safe and effective therapies; instead, a few case reports detailing the administration of clomipramine, flunarizine, nifedipine, topiramate and carbamazepine to small numbers of patients have been released [2,15,22]. Providing knowledge and reassurance may help lower the frequency of episodes of EHS [18]. Further research studies are needed to provide more accurate treatments for EHS. Treatment of EHS is described in [Table/Fig-4] [15,22,33].

Treatments	Effectiveness	Evidence level
Topiramate	Reduced symptom severity (loud buzz and bang)	Case reports [33].
Other medications (clomipramine, flunarizine, nifedipine, carbamazepine)	Varying reports of effectiveness	Case reports [15,22].
Education and reassurance	May reduce episode frequency	Expert opinion
Clinical trials	Not yet conducted for specific EHS treatment	N/A

[Table/Fig-4]: Treatment of Exploding Head Syndrome (EHS) [15,22,33].

Despite being a non life-threatening disorder, EHS can alter the ability to sleep, cause anxiety, and disrupt peace of mind [1,2]. These abrupt sounds at the onset of sleep lead to sleep disruption, insomnia and subsequent fatigue during the day [11]. However, many people experience anxiety related to sleep and fear that these episodes could be signs of some severe diseases [22]. At times, EHS is related to hypnic jerks, which are a physical component of the problem [16]. Because the condition is purely subjective, it may make the patient feel lonely or embarrassed, as others cannot hear the noises, which is a significant source of emotional and psychosocial stress [1,24]. Hypnic jerks, nocturnal seizures, migrainous auras that mimic various features of EHS and PTSD flashbacks are differential diagnosis of EHS [4,16,24,33]. EHS may be secondary to other conditions that present with similar symptoms but may not be exactly the same; for example, pain, movement disorders, or may have a neurological basis [1,12].

CONCLUSION(S)

The EHS is a rare and fascinating sleep disorder marked by auditory hallucinations that occur as the patient transitions from sleep to wakefulness. The present literature review explores various aspects of EHS symptoms, possible causes, and how it is categorised in sleep disorder manuals. The inability to identify a single cause highlights the complexity of EHS, as numerous theories have been proposed. Topiramate is one treatment option that shows promise, but further studies and clinical trials are needed. This thorough analysis clarifies the current understanding of EHS and emphasises the need for additional research to improve management, diagnostics and treatment approaches.

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