An unsuspected and unrecognized cause of medication overuse headache in a chronic migraineur—essential oil-related medication overuse headache: A case report

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Abstract
Essential oils are widely used by people for common ailments like headache and backache. We report a case of chronic daily headache in an adolescent migraineur refractory to most antimigraine drugs secondary to topical application of essential oils containing camphor and eucalyptus. A 14-year-old boy presented with chronic daily headache of 1-year duration, refractory to four antimigraine drugs including valproate and topiramate. He was daily applying a balm called Amruthanjan (10% camphor and 14.5% eucalyptus) on his forehead to relieve headache. Patient had complete relief of headache in 2 weeks after stopping the balm application. All his antimigraine drugs were tapered and stopped over a period of 3 months. At 1-year follow-up, he is headache free. Brain-stimulant essential oils of camphor and eucalyptus may be an important unrecognized cause of medication overuse headache.

Keywords
camphor, chronic migraine, essential oils, eucalyptus, medication overuse headache

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Introduction
Essential oils with brain stimulatory properties are used and abused by people for common ailments like headache and backache, thinking they are natural and safe. Essential oil-related medication overuse headache (EORMOH) may be an important unrecognized cause of medication overuse headache (MOH). Here, we report a case of chronic daily headache in an adolescent migraineur refractory to most antimigraine drugs secondary to topical application of essential oils containing camphor and eucalyptus. The headaches almost completely disappeared once the essential oil application was stopped.

Case presentation
A 14-year-old boy was referred for management of medically refractory chronic daily headache. He had infrequent migraines for the last 3 years but for the past 1 year, his headaches had become daily. He was on an adequate dose of four antimigraine drugs (valproate 600 mg, topiramate 50 mg, amitriptyline 25 mg, and flunarizine 10 mg) for the past 6 months but none of them had any effect on his headache. His headache satisfied the International Classification of Headache Disorders 3rd edition (ICHD3) definition of chronic migraine. His magnetic resonance (MR) imaging of the brain and MR venogram were unremarkable. A lumbar puncture with cerebrospinal fluid (CSF) manometry...
and CSF analysis were normal. He was following all the lifestyle changes advised by the previous doctor and was not on any analgesics, triptans, or ergot preparations. Botulinum toxin injection was planned but family was unwilling as they could not afford the treatment. The dose of valproate was increased to 800 mg, but the patient came after 2 weeks for persisting headache. We were perplexed and was pondering what to do next. Suddenly, it came to mind to ask him whether he was applying any balms for his headache. He told he was applying a balm called Amruthanjan (10% camphor and 14.5% eucalyptus) daily on his forehead to relieve headache for the past 1 year. During the early episodes of migraine, he felt relief after application of the balm but later when it started daily, he did not feel much relief. But still he continued to use the balm as it had produced relief during his early headache attacks. We asked him to stop the application of the balm completely. When he came for follow-up after 2 weeks, his headache had completely subsided. His medications were tapered and stopped over a period of 3 months. He is almost headache free at 1-year follow-up with very infrequent migraine and stopped over a period of 3 months. He is almost headache free at 1-year follow-up with very infrequent migraine attacks (once in 3–6 months), which gets relieved by rest and sleep.

**Discussion**

This case highlights the importance of enquiring about the use of complementary and alternative therapy in patients with refractory headache. Essential oils containing balms and ointments are often used by people as an over-the-counter remedy for common ailments. A brief survey done at our center involving 150 people showed that 86% of them were using these essential oils as an immediate remedy to common cold, headache, and backaches (unpublished data). Most of these balms contain essential oils of camphor and eucalyptus. MOH is one of the most common chronic headache disorders with a worldwide prevalence of 1–2%. The exact pathophysiology of MOH is not known but changes in the serotonergic, dopaminergic, and endocannabinoid pathways are implicated. Though there are no studies on the essential oils of eucalyptus and camphor, the essential oils of lavender and cedar essential oils have shown to be improve postoperative pain in animal models and patients. These antinociceptive effects are mediated through the activation of descending pain controlling pathways by modulation of serotonergic, noradrenergic, dopaminergic, and endocannabinoid systems. Long-term alteration of these pathways and neurotransmitter systems by chronic application of essential oils may be the underlying mechanism behind the etiology of EORMOH.

Essential oils of both eucalyptus and camphor contain aromatic monoterpines like 1,8-cineole. They are brain stimulants with proconvulsant properties and are recognized causes of seizures in humans. 1,8-Cineole acts like pentylenetetrazol and increases sodium and calcium influx. It may be right to hypothesize that these essential oils may alter brain currents resulting in a hyperexcitable state of neurons and contribute to chronification of migraine. They may also counter the effect of antimigraine drugs acting through the blockade of sodium and calcium channels, resulting in pharmacoresistance. There is a total absence of any literature on the effects of brain stimulatory essential oils and headache. They may relieve acute headache attacks by an anti-inflammatory action or by acting as a counter irritant (gate theory of pain). The main component of eucalyptus and camphor, 1,8-cineole, has anti-inflammatory action. The anti-inflammatory action of 1,8-cineole has been studied in various animal models, human subjects, and asthmatic patients, and it is found to reduce the levels of proinflammatory cytokines like prostaglandin E2, leukotriene B4, interleukin-1β, and tumor necrosis factor-α. Thus, 1,8-cineole may be considered similar to nonsteroidal anti-inflammatory drugs (NSAIDs), which is an important cause of MOH. Whether to classify this EORMOH as 8.2.3.2 (NSAID overuse headache) or 8.2.3.3 (other nonopioid analgesic overuse headache) or as 8.2.8 (MOH attributed to other medication) is not clear as of now.

Another important point to consider is the possibility of a substance-related headache. Substance-related headache is diagnosed when a patient develops headache after the use of or exposure to a substance (8.1). Here, our patient applied the balm for the headache, which was already present before the application. The headache the patient was having had all the characteristics of migraine. Headache attributed to use of or exposure to other substances includes headache caused by herbal, animal, or other organic or inorganic substances given by physicians or nonphysicians with medicinal intent although not licensed as medicinal products (8.1.11). In the diagnostic criteria for substance use headache, the two important features are headache should develop within 12 h of exposure and headache should resolve within 72 h after stopping the exposure. In our case, the patient did not complain any worsening after application of the balm and headache took almost 2 weeks to resolve. Hence, we think this case does not satisfy the criteria for substance use headache.

Another possibility is that of triggering the migraine attacks by the stimulant properties of eucalyptus and camphor in the balm. But our patient had migraine attacks even before application of the balm and there was no history of worsening of the severity of headache attacks after the application of the balm. Indeed, during his initial attacks, he felt relief after the application but once it became daily, he did not feel any improvement or worsening after application of the balm. But still, he continued to use the balm thinking it may benefit as it had produced relief during his early headache attacks. So, this possibility of attacks triggered by eucalyptus and camphor appears unlikely in this patient and this case fits more into the definition of MOH.

More studies are needed in the future exploring the effects of these essential oils on both acute and chronic
migraine. Till further studies are done, it will be prudent for the physicians dealing with chronic headache patients to ask about the exposure to these essential oils and stop their usage as they may be an important unrecognized cause of MOH and pharmacoresistance.

**Conclusion**

Brain-stimulant essential oils of camphor and eucalyptus may be an important unrecognized cause of MOH. Further studies are needed in the future to evaluate the association of essential oils with MOH, chronification of migraine, and pharmacoresistance.

**Clinical implications**

This is the first literature report of EORMOH.

- Essential oils of camphor and eucalyptus may be an important unrecognized cause of medication overuse headache.
- Application of these essential oils may result in pharmacoresistance to antimigraine drugs.
- Clinicians should enquire about their use in chronic headache patients and should advise to stop all the brain stimulatory essential oils completely, as it may result in better headache control and ultimately complete headache freedom.

**Author contributions**

TM participated in writing and editing the report. SKJ participated in writing and editing the report. Both the authors read and approved the final manuscript.

**Informed consent**

The written informed consent was obtained from the patient for publication of this case report. A copy of the written consent is available for review by the Editor-in-Chief of this journal.

**Declaration of conflicting interests**

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

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