

Can Allodynia Predict Headache Related to Personal Protective Equipment for the Prevention of COVID-19?

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Abstract

In this complex context of coronavirus disease 2019 (COVID-19), headache medicine has been completely affected by this new reality, with new types of headaches directly or indirectly related to COVID-19 being detected. Personal protective equipment (PPE) was recommended for workers in many professions that did not previously require wearing masks leading to new headaches, or the exacerbation of past headaches, especially among health workers. A 57-year-old female working in a secondary care hospital had a history of migraine twice/month without aura and allodynia symptom checklist (ASC12) scored as 7 before COVID-19 outbreak. She began to work with PPE (surgical masks, face shield and surgical cap) and migraines became daily (bifrontal, pulsatile, with photophobia, nausea, vomiting and of severe intensity, visual analog scale: 7), starting after 1 h of wearing protective equipment and lasted for at least 6 h during the day. There was no adequate response to treatment. The headache frequency returned to twice/month after the patient stayed home 45 days due to another condition. It is hypothesized here that people with allodynia symptoms when exposed to PPE are more susceptible to the development of new headaches or to the worsening of existing primary headaches. The relationship between previous allodynia determined with the ASC12 questionnaire and new headaches, or past primary headaches that have become worse during the COVID-19 pandemic in workers using PPE, should be better investigated in order to clarify this hypothesis. Cutaneous allodynia could be related with the sensitivity to PPE and headache progression.

Keywords: Headache; Migraine; COVID-19

Introduction

Starting in December 2019, a new severe acute respiratory ill-

ness was identified in China, caused by a novel RNA beta-coronavirus and named severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2). The condition now known as coronavirus disease 2019 (COVID-19) rapidly spread from Asia to Europe and then to North America, becoming a global public health emergency and a pandemic after March 2020 [1].

The entire world was affected by this new reality, with great changes in daily routines and attributions. During the escalation of the COVID-19 outbreak, many people in the world were mandated or counselled to wear personal protective equipment (PPE) (i.e., masks, face shields and goggles), while in public places, hospitals and on conventional jobs. This is something considered to be uncomfortable. New headaches and the exacerbation of past headaches have been reported especially among health workers, as described in previous studies [2].

This case report describes a patient with previous migraine and allodynia who developed a refractory headache during the use of PPE for the prevention of COVID-19.

Case Report

A 57-year-old female working as a kitchen assistant in a secondary care hospital had a history of migraine without aura since she was a teenager. Her past medical history included gastroesophageal reflux disease, a pituitary microadenoma and dyslipidemia. Her first headaches started during her first menstruation, becoming more frequent over certain periods of time, and she was treated with prophylactic medication (i.e., amitriptyline 25 mg). Before COVID-19, the characteristics of the pain were bifrontal, pulsatile and of moderate to strong intensity (visual analog scale (VAS): 7), with nausea, vomiting and photophobia. The frequency was 1 - 2 times per month, with relief provided by common pain medication such as ibuprofen. The pain was triggered by fatigue, cold weather and skin stimulation caused by hair accessories, caps, hats and glasses. She usually wore contact lenses, without sensitivity. Her allodynia symptom checklist (ASC12) [3] was scored as 7 (sensitivity to necklace, glasses, tight clothes, ponytail, hair combing and exposure to cold), before March 2020 (Table 1).

In March 2020, after the outbreak of the COVID-19 pandemic, she began to work with PPE (surgical masks, face shield and surgical cap). She started to have daily migraine headaches

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Table 1. Questionnaire: Allodynia Symptom Checklist (Total Score = 7)

Question: How often do you experience increased pain or an unpleasant sensation on your skin during your most severe type of headache when you engage each of the following?					
	Does not apply (0)	Never (0)	Rarely (0)	Less than half of the time (1)	Half of the time or more (2)
1. Wearing a necklace					X
2. Wearing earrings			X		
3. Wearing glasses					X
4. Wearing tight clothes				X	
5. Wearing a ponytail				X	
6. Wearing contact lenses			X		
7. Shaving the face	X				
8. Taking a shower		X			
9. Combing the hair			X		
10. Resting the head on a pillow			X		
11. Exposure to cold				X	
12. Exposure to heat			X		

(bifrontal, pulsatile, with photophobia, nausea, vomiting and of severe intensity, VAS: 7), which began after 1 h of wearing protective equipment and lasted for at least 6 h during the day. The pain was resolved within 1 h after PPE removal. She used acetaminophen and ibuprofen analgesics for more than 15 days per month. She was seen by a neurologist. Brain magnetic resonance imaging (MRI) (T1, T2 and fluid-attenuated inversion recovery) was performed, with normal results, except for the small 5 mm pituitary microadenoma present in a previous MRI and unchanged. Preventive treatment with a 10 mg nortriptyline dose was initiated, analgesics were decreased to non-abusive levels (twice/week) and an attempt was made to replace the face shield with protective goggles (in this case because the patient related that face shield was the worst equipment for her). There was no adequate response (the daily frequency persisted with lower intensity; VAS: 5) and the pain persisted for 7 months. In November 2020, the patient stopped working in order to undergo orthopedic surgery. She stayed at home for 45 days, without PPE. The headache showed a surprising improvement and returned to the previous frequency (twice a month).

Discussion

This is a presentation of a headache that exacerbated with the use of PPE. It completed some criteria for the International Classification of Headache Disorders Third Edition (ICHD-3) external compression headache, but it better accounted for by an ICHD-3 chronic migraine diagnosis. In addition, cutaneous allodynia could be related with the sensitivity to PPE and disease progression.

In this complex context of COVID-19, headache medicine has been completely affected by this new reality, with new types of headaches directly or indirectly related to COVID-19 being detected [1, 2]. PPE was recommended for workers in many professions that did not previously require wearing

masks such as healthcare and childcare, among others. A Singapore study of headaches among healthcare workers during COVID-19 reported that 128 out of 158 respondents (81.0%) developed *de novo* PPE-associated headaches. A pre-existing primary headache diagnosis was independently associated with PPE headaches [2].

A previous study among healthcare providers wearing the N95 face mask during the 2003 severe acute respiratory distress syndrome (SARS) epidemic reported a new onset of face mask-associated headaches with a prevalence rate of 37.3% [3]. The literature about PPE-associated headaches, specifically the combined usage of the N95 face mask and protective eyewear (goggles) is scarce [4, 5]. Most of the PPE-associated headaches in previous studies fulfill the International Classification of Headache Disorders criteria for external compression headache [6].

The pathogenesis of mask-associated headaches could possibly involve several etiologies such as mechanical factors (external compression), hypoxemia, hypercarbia or associated stress. In addition, pressure from the mask and/or goggles together with the accompanying straps may lead to local tissue damage and exert an irritative effect on the underlying superficial sensory nerves (trigeminal or occipital nerve branches) innervating the face, head and cervical region [2].

The sensitivity to this equipment could be explained by hypersensitivity in the face and head, which is known as allodynia. Cutaneous allodynia is characterized by pain provoked by stimulation of the skin that would ordinarily not produce pain. The underlying mechanism of facial allodynia is sensitization of the nociceptive neurons in the trigeminal nucleus caudalis, which receives convergent afferent input from the dura mater and periorbital skin. Clinical studies suggest that it is a marker of central sensitization and a risk factor for progression to chronic headaches [7]. Dodick et al described in 15,133 individuals with migraine that allodynia was present in 39.9%. It was significantly associated with a higher migraine symptom severity score (odds ratio: 1.17, confidence interval: 1.15 - 1.19) and more severe pain

intensity (odds ratio: 1.11, confidence interval: 1.08 - 1.14) [8].

It is hypothesized here that people with allodynia symptoms when exposed to PPE are more susceptible to the development of new headaches or to the worsening of existing primary headaches. The relationship between previous allodynia determined with the ASC12 questionnaire [7] and new headaches or past primary headaches that have become worse during the COVID-19 pandemic in workers using PPE should be better investigated in order to clarify this hypothesis. In addition, since the use of PPE is indispensable during this pandemic, we suggest some recommendations to minimize discomfort and headaches: avoiding excessive compression by the equipment, regulating size and adjustment of elastic bands for each head size, routinely applying and prioritizing “fit tests” (to define the best mask size), choosing lighter equipment whenever possible (especially goggles), reducing working hours without rest and starting preventive treatment for headaches caused by PEP as early as possible, always avoiding painkiller overuse.

Conclusion

This case report describes a patient with previous migraine and allodynia who developed a refractory headache during the use of PPE for the prevention of COVID-19. It is hypothesized here that cutaneous allodynia could be related with the sensitivity to PPE and disease progression.

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Financial Disclosure

None to declare.

Conflict of Interest

None to declare.

Informed Consent

Informed consent was obtained.

Author Contributions

Karen dos Santos Ferreira: research design, data collection and

manuscript preparation. Ana Miriam Velly: research design and manuscript preparation.

Data Availability

The authors declare that data supporting the findings of this study are available within the article.

Abbreviations

SARS-CoV-2: severe acute respiratory syndrome coronavirus 2; COVID-19: coronavirus disease 2019; PPE: personal protective equipment; ASC12: allodynia symptom checklist; MRI: magnetic resonance imaging; ICHD-3: The International Classification of Headache Disorders Third Edition; VAS: visual analog scale

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