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ART AS A DIAGNOSTIC TOOL FOR MIGRAINE: A NARRATIVE REVIEW

A ARTE COMO UMA FERRAMENTA DIAGNÓSTICA PARA MIGRÂNEA: UMA REVISÃO NARRATIVA

EL ARTE COMO HERRAMIENTA DE DIAGNÓSTICO DE LA MIGRAÑA: UNA REVISIÓN NARRATIVA

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ABSTRACT
Migraine verbal description poses great difficulty, since it is a subjective experience. This narrative review aimed to gather the main representative artistic patterns of the clinical manifestations of migraine and demonstrate their applicability in medical education and clinical practice as an auxiliary tool for this diagnosis. The following databases were searched: Medical Literature, Analysis, and Retrieval System Online (MEDLINE), Scientific Electronic Library Online (SciELO), Latin American and Caribbean Health Sciences Literature (LILACS), and Portal de Periódicos da Coordenação de Aperfeiçoamento de Pessoal de Nível Superior do Ministério da Educação (CAPES/MEC). The following descriptors were combined in each database using Boolean operator: “Medicine” AND “Art” AND “Migraine”; “Medicine in the arts” AND “Migraine”; “Migraine” AND “Arts” (English); “Medicina” E “Arte” E “Migrânea”; “Medicina nas artes” E “Migrânea”; “Migrânea” E “Artes” (Portuguese); “Medicina” Y “Arte” Y “Migraña”; “Medicina en las artes” Y “Migraña”; “Migraña” Y “Artes” (Spanish). In addition, visual depictions of the main clinical manifestations of migraine were searched on the website Wellcome Collection to illustrate this study. In total, 29 articles were selected, as well as nine images that belong to the Migraine Art Competition Collection. Auras were the most commonly portrayed phenomena, and scotomas, fortification spectra, corona phenomenon, the splitting of the body image, microsomatognosia, and macrosomatognosia were described and analyzed. The representations of the unilateral aspect of migraine and the prodromal and post-prodromal symptoms such as nausea, photophobia, and phonophobia were also common. We highlight the relevance of art as a migraine diagnostic tool given its easy implementation in clinical practice and medical education.

KEYWORDS: Migraine art. Headache. Migraine diagnostic tool. Aura. Drawing. Medical education.

RESUMO
A descrição verbal da enxaqueca apresenta grande dificuldade, pois é uma experiência subjetiva. Esta revisão narrativa teve como objetivo reunir os principais padrões artísticos representativos das manifestações clínicas da migrânia e demonstrar sua aplicabilidade na educação médica e na prática clínica como ferramenta auxiliar neste diagnóstico. As seguintes bases de dados foram pesquisadas: Medical Literature, Analysis and Retrieval System Online (MEDLINE), Scientific Electronic Library Online (SciELO), Literatura Latino-Americana e do Caribe em Ciências da Saúde (LILACS) e Portal de Periódicos da Coordenação de Aperfeiçoamento de Pessoal de Nível Superior do Ministério da Educação (CAPES/MEC). Os seguintes descritores foram combinados em cada banco de dados usando operador booleano: “Medicine” AND “Art” AND “Migraine”; “Medicine in the arts” AND “Migraine”; “Migraine” AND “Arts” (inglês); “Medicina” E “Arte” E “Migrânea”; “Medicina nas artes” E “Migrânea”; “Migrânea” E “Artes” (português); “Medicina” Y “Arte” Y “Migraña”; “Medicina en las artes” Y “Migraña”; “Migraña” Y “Artes” (espanhol). Além disso, as representações visuais das principais manifestações clínicas da enxaqueca foram pesquisadas no site Wellcome Collection para ilustrar este estudo. No total, foram selecionados 29 artigos, além de nove imagens pertencentes à Migraine Art Competition Collection. As auras foram os fenômenos mais comumente retratados, e escotomas, espectros de fortificação, fenômeno corona, divisão da imagem corporal, microssomatognosia e macrossomatognosia foram descritos e analisados. As representações do aspecto unilateral da enxaqueca e dos sintomas prodrômicos e pós-prodrômicos, como náusea, fotofobia e fonofobia,

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também foram comuns. Destacamos a relevância da arte como ferramenta diagnóstica da enxaqueca, dada sua fácil implementação na prática clínica e na educação médica.

PALAVRAS-CHAVE: Arte sobre enxaqueca. Dor de cabeça. Ferramenta de diagnóstico de enxaqueca. Aura. Desenho. Educação médica.

RESUMEN
La descripción verbal de la migraña presenta una gran dificultad, ya que se trata de una experiencia subjetiva. Esta revisión narrativa tuvo como objetivo recopilar los principales patrones artísticos que representan las manifestaciones clínicas de la migraña y demostrar su aplicabilidad en la educación médica y la práctica clínica como herramienta auxiliar en este diagnóstico. Se realizaron búsquedas en las siguientes bases de datos: Medical Literature, Analysis and Retrieval System Online (MEDLINE), Scientific Electronic Library Online (SciELO), Literatura Latino-Americana y del Caribe en Ciencias de la Salud (LILACS) y Portal de Periódicos da Coordenação de Aperfeiçoamento de Pessoal de Nível Superior do Ministério da Educação (CAPES/MEC). Los siguientes descriptores se combinaron en cada base de datos utilizando operador booleano: “Medicine” AND “Art” AND “Migraine”; “Medicine in the arts” AND “Migraine”; “Migraine” AND “Arts” (inglés); “Medicina” E “Arte” E “Migrânea”; “Medicina nas artes” E “Migrânea”; “Migrânea” E “Artes” (portugués); “Medicina” Y “Arte” Y “Migraña”; “Medicina en las artes” Y “Migraña”; “Migraña” Y “Artes” (español). Además, se buscaron representaciones visuales de las principales manifestaciones clínicas de la migraña en el sitio web Wellcome Collection para ilustrar este estudio. En total se seleccionaron 29 artículos, además de nueve imágenes pertenecientes a la Migraine Art Competition Collection. Las auras fueron los fenómenos representados con mayor frecuencia, y se describieron y analizaron escotomas, espectros de fortificación, fenómeno de corona, división de la imagen corporal, microsomatognosia y macrosomatognosia. También fueron comunes comunes las representaciones del aspecto unilateral de la migraña y síntomas prodrómicos y posprodrómicos como náuseas, fotofobia y fonofobia. Destacamos la relevancia del arte como herramienta diagnóstica de la migraña, dada su fácil implementación en la práctica clínica y la educación médica.

PALABRAS CLAVE: Arte sobre la migraña. Dolor de cabeza. Herramienta de diagnóstico de la migraña. Aura. Diseño. Educación médica.

INTRODUCTION

The term migraine derives from “hemicrania” in a reference to the common unilateral characteristic of the pain[1,2] that is defined as a primary headache.[3,4] Despite being considered an underestimated disease, globally underdiagnosed, and undertreated,[2] migraine has been ranked fourth among the leading causes of disability-adjusted life years in both genders at all ages, the third in women at all ages, and the second in women of childbearing age,[5] affecting over one billion people worldwide each year.[6]

Two types of migraine can occur, with or without aura.[1,3,4] On the one hand, migraine with aura can be described as recurring attacks of visual, sensory, or other fully reversible unilateral symptoms of the central nervous system that last minutes. They usually develop gradually and are followed by headaches and associated migraine symptoms. The most common aura is visual and occurs in more than 90% of the patients presenting with this condition, who describe scotomas and/or fortification spectra.[3,4,7–22] Additionally, auras from a sensory nature are also common, in the form of pins and needles moving slowly from the point of origin and affecting the body, face, and/or tongue.[23] Due to its visual manifestations, intense, disabling pain and unpredictable crises, migraines with aura have been

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an artistic inspiration for several famous painters such as Pablo Ruiz Picasso (1881–1973) and Salvador Dalí i Domènech (1904–1989).[18,22] On the other hand, migraine without aura refers to recurrent headache attacks that can last from 4 to 72 hours, can be aggravated by physical activities, and are often associated with nausea and/or photophobia and phonophobia. Among its typical characteristics are the unilateral location, pulsating quality, and moderate to severe intensity.[4]

Given that migraine experience is subjective and variable, its verbal description poses great difficulty.[15] Thus, drawings are considered an especially useful tool for patients with difficulties to verbally explain their condition, since it is possible to identify elements compatible with the symptoms of migraine in these images. Based on that, the use of illustrations is a cheap adjunct method in clinical practice and a potent aid for the differential diagnosis of headaches.[13,15,16,20,21,23,24–28] Taking into account the relevance of the topic and aiming to disseminate and spread knowledge on this theme, competitions are often held so that patients can express their suffering in an artistic way.[25,29] These clinical manifestations expressed through works of art by famous painters and ordinary people suffering from migraine portray painful symptoms (hemicranial pulsatile headache),[8,10,13,16,19–21,24,25,27,28,30] non-painful symptoms (vomiting),[8,9,11,13,16,20–22,29,30] sensory symptoms (body dysmorphisms, vertigo, amaurosis, osmophobia, photophobia, phonophobia),[9,10,13,16,17,19–22,24,28,29–34] and motor symptoms (hemiplegia, aphasia, diplopia).[12,25,35] These artistic expressions are relevant in medical propaedeutic and emerge as a powerful tool for understanding migraine symptoms, helping health professionals reach the correct diagnosis in clinical practice both in offices and in emergency units.

In view of the importance of works of art as a way of expressing the subjective characteristic of pain and their relevance in the management of migraine to identify the symptoms that affect patients, in this narrative review we aimed to verify the most representative artistic patterns of the clinical manifestations of migraine. Furthermore, we intended to demonstrate the applicability of this knowledge in medical education and clinical practice, as an auxiliary tool for the diagnosis of migraine.

METHODS

This is a qualitative study based on a narrative review of the literature on migraine artistic expression. The databases consulted to carry out this review were: Medical Literature, Analysis, and Retrieval System Online (MEDLINE), Scientific Electronic Library Online (SciELO), Literatura Latino-Americana e do Caribe em Ciências da Saúde (LILACS), and Portal de Periódicos da Coordenação de Aperfeiçoamento de Pessoal de Nível Superior do Ministério da Educação (CAPES/MEC). The following descriptors were retrieved from the Medical Subject Heading Terms (MeSH) and combined in each database using Boolean operators: “Medicine” AND “Art” AND “Migraine”; “Medicine in the Arts” AND “Migraine”; and “Migraine” AND “Arts” (English); “Medicina” E “Arte” E “Migrânea”; “Medicina nas artes” E “Migrânea”; “Migrânea” E “Artes” (Portuguese); “Medicina” Y “Arte” Y “Migraña”; “Medicina en las artes” Y “Migraña”; “Migraña” Y “Artes” (Spanish).

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The inclusion criteria were: 1. articles published in English, Portuguese, or Spanish; 2. articles with titles or abstracts directly related to the way painters express their pain and anguish resulting from migraine through the art they produce. In addition, the following exclusion criteria were adopted: 1. articles on intervention, epidemiology, etiology, pathophysiology, prevention, imaging findings, impact on quality of life, biomarkers, diagnostic algorithms, consensus, evolution, and/or definition of headaches or other diseases; 2. articles on medical history not related to migraine art; 3. animal studies; 4. articles on migraine related to other art forms except painting; 5. editorials, errata, and/or comments; 6. articles about using painting as a test to measure someone's knowledge of migraine; 7. articles on how someone's art can change after the artist is affected by a neurological disorder.

Representations of the main symptoms that are part of the clinical picture of migraine were searched on the website Wellcome Collection[36] aiming to illustrate the relationship of this type of headache with visual field defects and visual hallucinations, in addition to manifestations unrelated to vision, which can be portrayed, nevertheless. Visual field defects were assessed according to their unilateral or bilateral nature, shape, and extent. Among the filters used in this selection, visual disturbance, fortification, zigzags, corona, pain and disease, body distortions, splitting, nausea, and vomiting were included.

RESULTS AND DISCUSSION

The searches performed in the aforementioned electronic databases initially resulted in 4,521 articles. After applying the exclusion criteria, 64 articles were selected, and 35 of them were excluded due to duplication. The remaining 29 articles were selected for this narrative review (Figure 1, Table 1).

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Figure 1. Data collection during this narrative review.

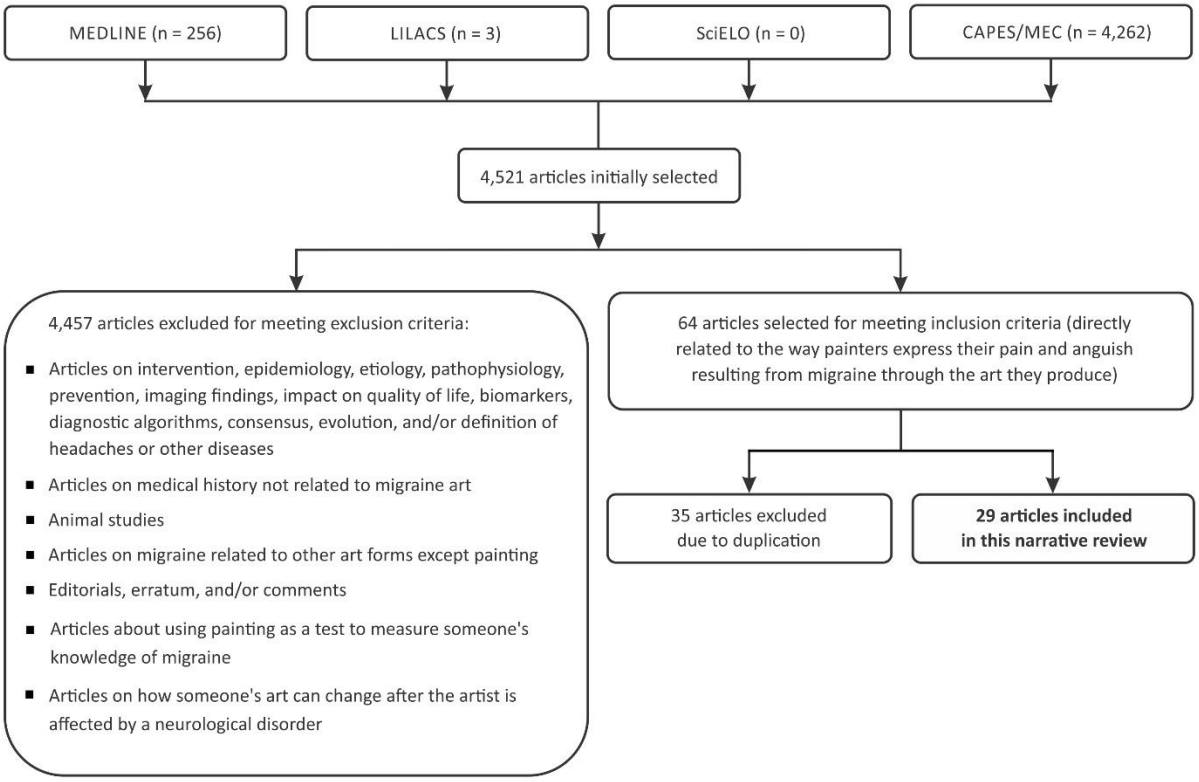

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Table 1. Articles selected in this narrative review.

Characteristic elements and/or clinical manifestations in drawings/paintings	Main conclusions	Reference
Representations of ways to deal with pain (use of pressure, silence, sleep, and medication), predominant use of red and black.	Children's pain drawings can be reliably categorized by content and dominant color. These images can be used in therapeutic methods of pain control.	Unruh et al.[27]
Fortification spectra, visual loss, mosaic vision, metamorphopsia, micropsia, scotomas, predominant use of primary colors (red, blue, and yellow), and objects striking the head.	The Migraine Art Competition was an opportunity to see a great number of works of art of people's migraine experiences. The recurring trends (hemianopia and fortification spectra) could be observed in a large number of images.	Wilkinson and Robinson[7]
Nausea, vomiting, headaches, abdominal pain attacks, scotomas, and visual hallucinations.	The symptoms acknowledged in De Chirico's paintings suggest that he used his migrainous visual hallucinations as a source for some of the details of his work.	Fuller and Gale[8]
Depressive representations, helplessness, crying, frustration and anger, illustrations of themselves dead, dying, or about to be killed, photophobia, phonophobia, nausea, and visual disturbances.	Affective and cognitive information about painful experiences are conveyed in children's headache drawings, and so are the location and quality of pain, especially when color is considered. This allows the caregiver to directly address the concerns and undeclared fears that children have.	Lewis et al.[28]
Cenesthesia, unilateral pain, photophobia, phonophobia, nausea, vomiting, scintillations, contracted visual fields, hemianopia and visual illusion	Artistic skills allowed migraine sufferers to provide a vivid representation of cenesthetic sensations of pressure and	Podoll et al.[30]

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of autokinesis, pulsating pain, hammering pain, feeling of pressure, and sensation of pulling.	pulling as repeatedly experienced during their attacks of migraine with typical aura.	
Out-of-body experiences, phonophobia, photophobia, geometric visual hallucinations, achromatopsia, fortification spectra, metamorphopsia, visual distortions, vomiting, micro/macrosomatognosia.	The out-of-body experiences and related phenomena can occur as migraine aura symptoms, which supports the notion that they represent a preformed functional response of the brain.	Podoll and Robinson[9]
Micro/macrosomatognosia, autoscopy, visual hallucination, visual illusions, and aphasia.	Microsomatognosia experiences prevail over macrosomatognosia in the body schema disturbance with a clear preponderance of the head and upper extremity regions.	Podoll and Robinson[35]
Visual loss, zigzag clouds, scotomas, metamorphopsia, macropsia, poliopsy, nausea, paraesthesia, unilateral pain, pulsating pain, photophobia, phonophobia, dysarthria, ataxia, and aschematia.	J.J. Ignatius Brennan had migraine experiences as a factor of artistic creativity. His experiences of basilar migraine were undoubtedly one of the sources of his inspiration.	Podoll and Robinson[10]
Illusory splitting, scotomas, fortification spectra, loss of color perception, visual illusions, visual loss, and vomiting.	Illusory splitting is strongly associated with elementary visual hallucinations of varying shapes and dimensions.	Podoll and Robinson[11]
Scotomas, hemianopsia, loss of vision, visual hallucination, mosaic vision, metamorphopsia, teleopsia, micropsia, corona phenomenon, autoscopy, nausea, and aphasia.	The corona phenomenon can appear with a single or two extra contours surrounding parts or the complete contours of an object, in black, white, or in the color of the object it surrounds. Also, it can be seen around perceived, illusory, and hallucinatory images.	Podoll and Robinson[12]

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Phosphenes, visual loss, phonophobia, photophobia, nausea, and osmophobia.	Sarah Raphael's "blinding migraine" was a source of artistic inspiration to her "Strip" series painting.	Podoll and Ayles[31]
Splitting of the body image, photopsies, sparks coming out of the eyes, visual hallucinations, exhaustion, photophobia, phonophobia, micro/macrosomatognosia, and out-of-body experience.	The topological distribution of splitting of the body image shows that the head and upper extremities are the body parts most frequently involved in this phenomenon, which may reflect the principles of organization of sensory maps in the human brain.	Podoll and Robinson[32]
Throbbing pain, pulsating sensation, unilateral pain, colored spots, scintillating forms, scotomas, photophobia, phonophobia, nausea, vomiting, palpitation, paresthesia, ptosis, and periorbital pain.	Children's headache drawings are a simple, inexpensive aid in the diagnosis of headache type. The use of drawings is encouraged in the evaluation of any child with a headache as an adjunct to the clinical history and physical examination.	Stafstrom et al.[13]
Nausea, abdominal complaints, gustatory hallucinations, visual illusions and hallucinations, phosphenes, anxiety, fear, and recurrent impairments of consciousness.	De Chirico might have suffered from interictal and ictal manifestations of epilepsy rather than from migraine, given the absence of recurrent headaches and other typical migraine features.	Blanke and Landis[37]
Pounding pain, photophobia, sonophobia, visual obscurations, and nausea.	Children's headache drawings are useful for the diagnosis of headache type and provide valuable insights into their experience of pain. They can also be used to provide information about the clinical course of their condition.	Stafstrom et al.[24]
Photophobia, phonophobia, nausea, vomiting, diplopia, illusory visual splitting, olfactory and sensory	Creating art for a contest differs from the creation process for the art market in general. This may limit the use of the former for a neuropsychological study of artistic production.	Podoll[29]

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disturbances, macrosomatognosia, and illusory splitting of the body.	Nevertheless, almost the same spectrum of symptoms can be discerned by neurological analysis in arts produced by both artistic creation processes.	
Phosphenes, zigzags, fortification spectra, visual hallucinations with geometric shapes (stars, squares, triangles, crosses, spirals), headache, and abdominal complaints.	Sarah Raphael achieved a provocative synthesis of figurative and abstract art, in which figurative representations of geometric patterns of migrainous origin are amalgamated with abstract imagery.	Podoll and Ayles[14]
Impaired concentration, disturbed cognition, scotomas, fortification spectrum, zigzags, out-of-body experiences, corona phenomenon, illusory splitting, micro/macrosomatognosia.	Illustration provides an invaluable method for elucidating underlying processes in the brain. It is also useful in the differential diagnosis of migraine. Particularly when made during the attack, drawings provide a powerful tool that allows an objective analysis of a subjective experience.	Schott[15]
Sadness and weeping, decubitus, scotomas, photopsies, nausea, vomiting, photophobia, phonophobia, bitemporality, and pulsating pain.	The “artistic diagnosis” is an independent predictor of the clinical diagnosis of migraine because a significant association has been found between them.	Mosquera and Martino[16]
Sharp elements (lightning, arrows, needles, hammers), cracked head, devil, whirl in the head, hemianopsia, noises, electric current, predominant use of black and red.	Drawings have great value for the differential diagnosis of headaches. However, this value depends on the physician’s personal experience in their interpretation.	Wojaczyńska-Stanek et al.[23]
Scotomas, photopsies, metamorphopsia, depersonalization sensation, sensory disturbances, and abdominal complaints.	No works of art that explicitly include the word migraine have been found before the 1970s. Probably, migrainous artists	Palacios[17]

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	who previously left traces of this entity in their works were not sure that what they felt was due to this primary headache.	
Nausea, photophobia, abdominal pain, olfactory-gustatory hallucinations, visual disturbances, autoscopia, recurrent feeling of depersonalization-derealization, and macrosomatognosia.	A careful study of De Chirico's life and his own writings suggests that while he probably suffered from recurrent malaria, he had neither migraine nor epilepsy. His work may appear as a process to which organic brain dysfunction never contributed.	Bogousslavsky[33]
Illusory splitting, scotomas, elementary geometric hallucinations, and speech difficulties.	No proof has been found that Picasso suffered from migraine with aura.	Haan and Ferrari[18]
Scotomas, visual loss, fortification spectra, teleopsia, micro/macrosomatognosia, cenesthetic pain sensations, out-of-body experiences, phonophobia, photophobia, and illusory splitting of the body.	Migraine experiences can be a source of artistic inspiration. The uniform nature of the various hallucinations has been documented with a visual constancy. Such constant geometrical shapes are not dependent on memory, or personal experience, or desire, or imagination.	Aguggia and Grassi[19]
Sharp objects striking the head, scotomas, fortification spectra, photophobia, nausea, vomiting, phonophobia, vertigo and dizziness, unilateral/bilateral/diffuse pain, and sad expression.	Drawings used as an auxiliary tool for migraine diagnosis are also a useful instrument for migraine differential diagnosis. Their inclusion in childhood headache diagnostic assessment is suggested.	Mazzotta et al.[20]
Diplopia, scotomas, field defects, blurred/tunnel vision, zigzags, spots, pain type (pounding/exploding, pressure) by objects striking the head (hammers,	Diplopia was depicted in a significantly higher percentage of pseudotumor drawings than migraine drawings. Regarding other symptoms, headache drawings from children with pseudotumor cerebri were similar to those drawn by children	Lee et al.[21]

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bombs), photophobia, phonophobia, dizziness, vomiting, and recumbency.	with migraine. The adoption of this simple method as an adjunctive aid for headache differential diagnosis is suggested.	
Visual aura with and without headache, non-visual aura, presence of points and colors, loss of strength in half of the body, difficulty in speaking, tingling in half of face or body.	Art contests can be useful tools for diagnosing and treating migraines.	Dias et al.[25]
Episodic dizziness, history of classical migraine, headache, photophobia, phonophobia, and visual and position triggered vertigo with no other otologial cause to explain symptoms, leading to the diagnosis of vestibular migraine.	Among many other medical/psychiatric sicknesses such as temporal lobe epilepsy, intermittent acute porphyria, Meniere's disease, lead poisoning, sexually transmitted infections, terpene/absinthe/alcohol abuse, ophthalmological disorders, chronic bipolar disorder, schizophrenia, personality and anxiety disorder and narcissism/neuroticism, the authors hypothesized that van Gogh could also have presented with vestibular migraine. They affirmed that besides influencing his art in use of colors, this type of migraine marked his depiction of the subjects with a consistent vertical tilt on the left.	Dasgupta et al.[34]
Migraine with visual aura lasting from 5 to 60 minutes, with or without headache, several visual symptoms such as bright lights, a flickering and irregular arc of light, bright lines, a blind spot in the visual field, spots, blurred	The diagnosis of neurological phenomena such as migraine may be facilitated by the analysis of works of art created by those affected by them. The artworks portrayed in the Migraine Art Competition Collection show the multifaceted	Gomes[22]

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vision, zigzag lines, scotomas, colored aura, as well as nausea, vomiting, sensitivity to light and sound.	experiences of migraine sufferers and how they interpret their distress.

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The term “migraine art”, attributed to Derek Robinson, refers to the visual representations of the symptoms and experience of this condition.[19] He was also the curator of the four Migraine Art Competitions, held between 1980 and 1987, assembling 545 works of art created by amateur artists from 8 to 73 years old, who experienced migraines.[36] They were asked to illustrate their migraine, highlighting their pain, visual disturbances, and the social impact of the disease on their lives.[12] Of all the images that belong to the Migraine Art Competition Collection, nine were selected to illustrate this study and depict migraine symptoms. The Wellcome Collection website permits the use of their images as long as the credit is given and the images are not changed in any way.[36]

Among the most commonly portrayed phenomena are scotomas and fortification spectra.[3,4,7–22] While the first are configured in an area of partial or complete blindness within a normal or relatively normal visual field,[4] the second derive from the similarity of the zigzag visual hallucination with the bastions that fortified the walls of medieval cities.[1,14]

Figure 2 depicts a scotoma representation perceived as a visual disturbance that leads to a visual field loss.[38] It shows a clock in which some numbers are not seen due to scotoma. On the right margin, it is possible to observe scrambled numbers, also common in representations of migraine aura, corresponding to distortions of the visual field.

Figure 2. Clock face with visual disturbance, 1981. Main theme: aura. Second theme: life. Original dimensions: 20.4 cm x 26.7 cm.[38]

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Fortification spectra can be seen in Figure 3.[39] The artist used pink and blue paint in a zigzag pattern, some other geometric shapes, and flashing lights, frequently experienced by many patients as part of migraine attacks. Furthermore, the image highlights the unilateral aspect of the pain represented as a visual aura occurring in only one eye. The portrait also highlights the impact that migraines have on everyday tasks by illustrating a mother holding a child and the world spinning and shining around her.

Figure 3. Family life with aura, 1985. Main theme: life. Second theme: aura. Original dimensions: 22.6 cm x 30.2 cm.[39]

Because scotomas and fortification spectra are such common symptoms reported by migraine patients, both are often represented together, as shown in Figure 4.[40] It is possible to visualize in this portrait a sparkling spot obstructing the visual field, accompanied by several colored zigzags. Interestingly, despite having been produced by different people, Figures 2, 3, and 4 bear uncanny similarities, confirming the uniformity of migraine visual expressions.[38–40]

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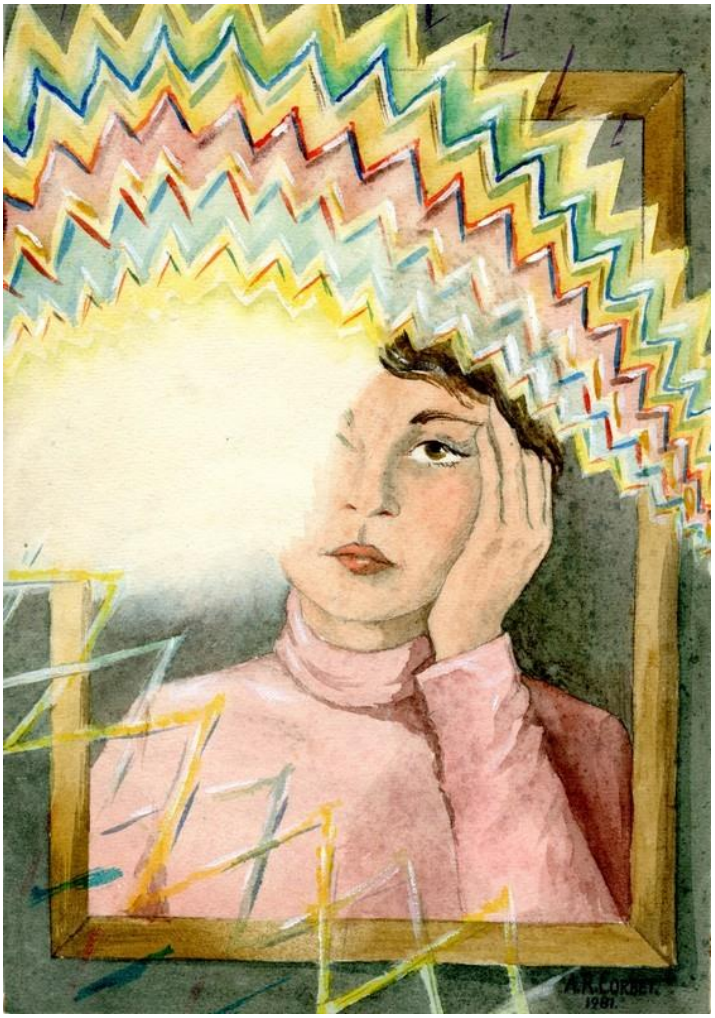
Figure 4. Woman in reflection with zigzag aura and white spot, 1981. Main theme: aura. Second theme: life. Original dimensions: 30.0 cm x 21.1 cm.[40]



The unilateral aspect of migraine has also been pointed out as an important characteristic when pain is expressed through art, since most of the works feature this aspect, as in Figure 5.[41] The artist may have chosen bees as a form of emphasizing the association between a migraine crisis and some external triggering factors. The insect attack on only one side of the character's head, together with the fact that the sky is cloudy on the affected side and sunny on the healthy one, demonstrate that the pain tends to be unilateral and excruciating.

Another visual manifestation experienced by those who suffer from migraine is translated into the corona phenomenon, in which the person has the illusion of extra edges around the objects.[12] This event is depicted all around the bird and the characters in Figure 6.[42] It is also associated with a large black scotoma in the center of the painting, a manifestation configured as a negative symptom, in contrast to scintillating scotomas, considered positive visual phenomenon.[12] Again, attention should be paid to the uniformity in the representation of an important symptom of migraine aura.

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Figure 5. "The Big Sting", 1983. Main theme: pain and sickness. Second theme: aura. Original dimensions: 22.7 cm x 29.3 cm.[41]

Figure 6. Couple on park bench with corona, 1985. Main theme: aura. Second theme: life. Original dimensions: 22.5 cm x 26.5 cm.[42]

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An aspect also experienced by individuals affected by migraine is the sensation of splitting of the body image, a symptom of somesthetic aura.[32] This manifestation is represented in Figure 7, a self-portrait showing the artist divided in half.[43] The symptom is accompanied by the sensation of sparks coming out of the eyes and flashing lights.[22]

Figure 7. Woman holding her head with visual disturbance, 1987. Main theme: pain and sickness. Second theme: aura. Original dimensions: 16.9 cm x 23.5 cm.[43]

Less frequent, but not less important, are the micro and macrosomatognosia phenomena, also known as Alice in Wonderland syndrome,[19] perceptual disorders of the body scheme in which the patients perceive abnormally small and large parts of their bodies, respectively.[35] Figure 8 depicts the teacher's feeling that her upper limbs are drastically enlarged in size, as well as the excruciating pain that accompanies migraine attacks, using red paint around the eyes and in the occipital region.[44]

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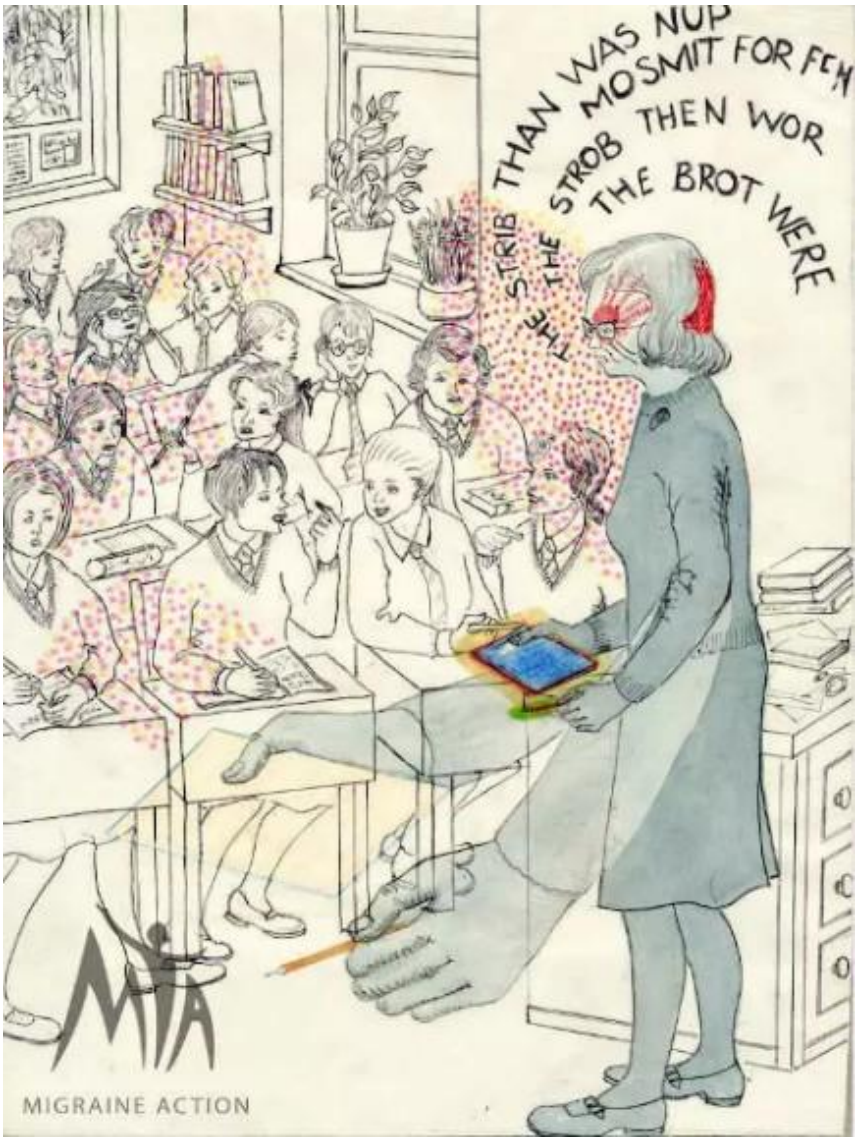
Figure 8. Teaching with a migraine, c.1985. Main theme: life. Second theme: *aura*. Original dimensions: 30.7 cm x 22.7 cm.[44]



Prodromal or post-prodromal phases, also common in migraine, may occur before or after the headache itself, respectively.[4] The symptoms may include irritability, fatigue, phonophobia, difficulty in concentrating, photophobia, and gastrointestinal symptoms such as nausea and vomiting.[3,4,13] Moreover, crises can be triggered by environmental factors such as stress, lack or excess of sleep, alcohol, caffeine, bright lights, odors, among others.[3,22] These phenomena are observed in Figure 9, which illustrates a variety of symptoms that may or may not occur simultaneously.[45] The subject is depicted lying in bed, alluding to the incapacitating characteristic of the headache, during a vomiting crisis, a striking symptom, in addition to the right hand resting on the head, indicating unilateral and severe pain. Other artifacts found around the image are also relevant in the representation of migraine symptoms such as a light bulb (photophobia), a radio with music notes around (phonophobia), a

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hammer (pulsatility), and many types of food (osmophobia), which can be prodromal symptoms or triggering agents. Furthermore, it is possible to visualize a relatively rare phenomenon, present in only seven images of the Migraine Art Competition Collection: the out-of-body experience. It is the feeling of being literally outside the physical body, observing it and its surroundings from a body external to the original one.[9] In Figure 9, this symptom is illustrated as a human-sized shadow, representing the parasomatic body of the experience, to the left of the patient's bed.[45] The series of question marks around the head of the shadow point out the confusion often caused by this type of migraine aura, as the patient wonders what is going on.[9]

Figure 9. Man being sick from bed, 1987. Main theme: pain and sickness. Second theme: *aura*. Original dimensions: 30.4 cm x 22.6 cm.[45]

Finally, Figure 10 summarizes the artistic clinical picture of migraine.[46] The sun and multicolored painting represent the discomfort of light stimuli, triggering painful crises caused by brightness, which is known as photophobia. The stars and rainbow portray the sparkling scotomas that generate visual hallucinations. The ongoing pregnancy suggests a genetic component of the disease. The excruciating intensity of the pain and the incapacitation it causes during migraine crises are conveyed by the attempt to detach the head from the body using the hand, splitting the body, as well as the exposure of the femur and tibia. The sensory alterations that affect people suffering from migraine are expressed by the disproportionate size of the hand and foot (macrosomatognosia) in addition to the out-of-body experience observed in the painting. The dark, somber images depict the intense, chronic

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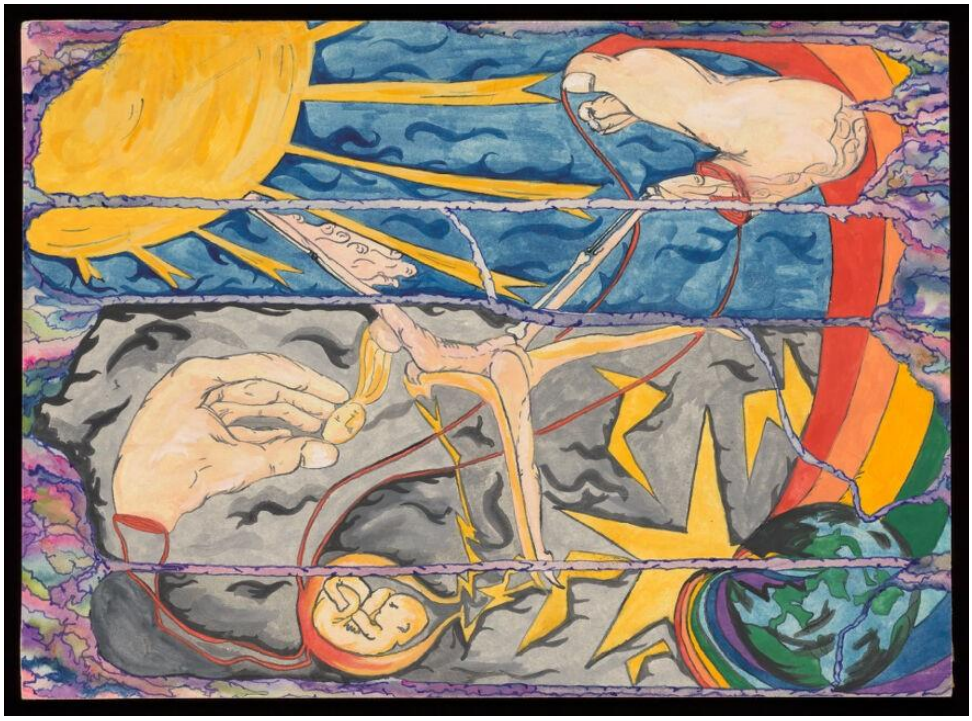
suffering generated by an incurable disease often associated with psychiatric comorbidities such as depression and anxiety disorder,[34,37] observed in migraine patients.

Figure 10. Body distortion, 1981. Main theme: child. Second theme: pain and sickness. Original dimensions: 20.5 cm x 28.2 cm.[46]



Evolution of migraine art throughout history

Migraine experiences have been inspiring a wide range of works of art throughout history.[17,19] It has been suggested that its first representations go back to ornamental designs found in caves and rocks in the Paleolithic period in the Stone Age.[10,19] However, one of the best-known and oldest descriptions and sketches that represent migraine was attributed to Hildegard von Bingen (1098–1180) by Charles Singer, a British medical historian. Hildegard was a German nun and mystic who experienced visions throughout her life, recognized by Singer as scintillating scotomas in her drawings.[7,17,19] Nonetheless, this matter is still under debate, since some authors state that Hildegard's drawings are suggestive, but not typical of migraine.[15,19] Because of this doubt about Hildegard's diagnosis, the illustration in a remarkable letter by Sir George Biddell Airy (1801–1892), an English scientist who was Astronomer Royal for 46 years, is considered a pioneer depiction of migraine, in which he drew scattered zigzags resembling "a Norman arch".[15]

At the beginning of the 20th century, the painter Giorgio de Chirico (1888–1978) probably also used migraine visual hallucinations as a source of inspiration for some of the most impressive details of his artwork.[8,19,33,37] De Chirico depicted not only typical visual auras, but also a variety of cenesthetic pain sensations resulting from a typical aura.[19,30] Despite that, de Chirico's diagnosis is still

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controversial, since it is hard to decide if the painter suffered from migraine or temporal lobe epilepsy, even though the absence of recurrent headaches and other typical migraine features argues against the former.[37] However, no organic brain dysfunction seems to have contributed to De Chirico's work.[33]

It is also speculated that Lewis Carroll (Charles Lutwidge Dodgson's pen name, 1832–1898), an English writer of children's fiction who was known to suffer from migraines, was inspired by this condition to write and illustrate two of his books, *Alice in Wonderland* and *Through the Looking Glass*.[1,17,19] In line with this, it is believed that Salvador Dalí i Domènech (1904–1989), a Spanish artist, created most of his bizarre images due to visual hallucinations associated with a migraine aura, and in 1969, a print run of *Alice in Wonderland* was launched with Dalí's surrealist illustrations.[19]

More recently, the "Strip" series of paintings, produced in the late 1990s by the English painter Sarah Natasha Raphael (1960–2001), were defined as comic strips, showing hundreds of tiny and very colorful images devoid of meaning and narrative. In fact, many art critics have observed that her paintings are very similar to the phosphene phenomenon, because they all depict blurring, dizziness, intensity, and lack a single focus, suggesting this migraine aura symptom.[14,31,37]

The visual impact created by works of art inspired by migraine experiences, an untapped source of information about sufferers' pain and visual disturbances, triggered the four international Migraine Art Competitions in the 1980's, sponsored by the British Migraine Association and WB Pharmaceuticals.[7,36] The paintings in the Migraine Art Competition Collection are powerful and deeply uncomfortable representations of the intense pain and disturbance caused by migraine, a painful experience beyond the scope of the scientific literature. They also make clear the value of art as a tool for communication and therapy in the doctor–patient relationship.[13,15,16,20,21,23–28,36,47]

Clinical applicability of migraine art

Illustrations bring an understanding of migraine and its auras in a way that words alone would never do.[19] Despite the subjectivity of the migraine experience, some degree of constancy is needed to be able to analyze the phenomena experienced during migraine attacks.[15] It is interesting to notice that, although the forms of verbal expression have been modified over the years, the patterns of visual expression of migraine through drawings and paintings have been relatively constant.[15] Thus, in view of this uniformity, it is possible to affirm that the visual arts are a useful tool both for the medical teaching of aspects related to the characteristics of migraine and auras, as well as for doctors to better understand patients' experiences. Therefore, drawings and paintings can be used as instruments to support the clinical diagnosis of migraine.[13,15,16,20,21,23–28,36,47]

The analysis of 207 paintings submitted to the first Migraine Art Competition, intended to illustrate migraine sufferers experience, revealed that 157 (90%) of them showed spectral appearances (stars, flashes of light, photopsy), 99 (48%) fortification spectra, 34 (16%) visual loss (scotomas), and 5 (2.5%) mosaic view. In addition, pain-like objects crushing or squeezing the head were demonstrated in 80 (39%) works of art, metamorphopsia in 32 (16%), and the condition that triggered it, either migraine or the situation the patient with migraine was experiencing, in 23 (11%).[7]

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A series of clinical studies demonstrated the clinical utility of drawings and paintings to represent the most important patterns of migraine symptoms.[13,16,20,23,28] In the United States, before collecting the clinical history of 226 children who had headache as the main complaint, the patients were asked to draw a picture of themselves with the headache.[13] As a result, 130 individuals were clinically diagnosed with migraine or mixed headache with a prominent migraine element, while a total of 139 drawings were considered migraine. The drawings representing headaches had a sensitivity of about 93% and a specificity close to 83% compared to the clinical diagnoses (gold standard), with positive and negative predictive values of 87.1% and 90.6%, respectively.

Another study, carried out in Argentina, included 48 individuals aged 5 to 19 years, who consulted for headaches.[16] Similarly, they were instructed to make a drawing that showed when and where it hurt, and other things that happened during the headache crises. The clinical diagnosis of migraine was confirmed in 23 of these patients, while 19 had an “artistic diagnosis”, which proved to be an independent predictor of clinical migraine diagnosis, achieving sensitivity of 69.6%, specificity of 88%, positive predictive value of 84.2%, and negative predictive value of 75.9%. The differences between the values found in the American[13] and Argentine[16] studies are probably due to the variation in sample size.

In addition to being a useful tool for diagnosing migraine per se, other studies have assessed the value of artwork as an instrument for the differential diagnosis between migraine and tension headache. In a study that included 100 children complaining of headache, they completed surveys to determine the type and characteristics of their headache.[28] They were also asked to draw pictures of how they felt during the headache attacks to verify their nonverbal perceptions. Most children (93%) illustrated characteristics that highlighted the nature and quality of their pain (hitting, hammering, throbbing), representing migraine, while those with tension headache designed belts around their heads.

In a Polish study, 124 children were asked to draw their headache without any additional suggestions.[23] Based on the analyses of the paintings, before the collection of any clinical history, a group of eight pediatricians and eight pediatric neurologists clinically diagnosed 40 children with migraine, 47 with tension headache, and 37 with other types of headache. Migraine was represented with sharp elements by 22 (55%) of the children diagnosed with this entity, with rays or arrows always pointing from the head, emphasizing the explosive character of their pain. Children with tension-type headaches mainly portrayed elements of compression (55.3%) and pressure (17%). Pointed elements were depicted by five (10.6%) of the children diagnosed with tension headaches, with arrows pointing to the head, suggesting pressure pain. However, mistakes were made, with a discrepancy between the clinical diagnosis and the artistic diagnosis of some children, so that the average percentage value of the correct diagnosis was 37.8–41.3%. This low outcome may have been caused by inadequate analysis of the drawings by the neurologists or lack of knowledge of the diagnostic criteria of the International Headache Society by the pediatricians.[4]

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In a study conducted in Italy, 67 patients aged between 6 and 14 years, with complaints of headache, were instructed to draw their headaches.[20] Additionally, 90 healthy children of the same age group were asked to depict a child suffering from headache. All the drawings were blindly and independently analyzed by two pediatric neurologists. After excluding five drawings of the group with headaches because of discordant diagnoses, of the 62 drawings evaluated, 35 (56%) were identified as migraine, of which five (14%) were false positive compared to the clinical diagnosis. The remaining 27 (44%) were classified as tension headache, of which five (18%) were false positive. In the drawings of the children diagnosed with migraine, an intense, throbbing, and pulsating pain was the most represented type, commonly illustrated as an object that strikes the head from outside or inside, or an exploding head, or even a fire in the forehead. They also depicted visual defects such as photophobia, represented as closed windows, or closed eyes, or aversion to light sources. In 25 (71%) illustrations an expression of sadness confirmed the severity of the pain. The total absence of associated symptoms was the main feature of the drawings made by the children diagnosed with tension-type headache.

Although some authors have found different sensitivity, specificity, positive predictive, and negative predictive values of the drawings, these contrasts can be attributed to different sample sizes, different instructions and requests made by the authors to the research participants, or little preparation of doctors to evaluate migraine drawings, which makes their interpretation more complex. In spite of these differences, several authors have unanimously agreed that the results confirm the usefulness of drawings in the diagnosis of children suffering from headache and indicate that this simple technique can be applied in the clinical setting.[13,16,20,23,28] As a rule, the diagnostic value of the illustrations depends on the knowledge and personal experience of these medical professionals for their interpretation.[23]

CONCLUSIONS

The strength of this study lies in the clarification of the artistic representations of common and/or hard-understanding symptoms of migraine, since one of the main obstacles found in the studies for the use of drawings as an instrument in clinical practice was the clinicians' and specialists' interpretation of the elements represented in the works of art.

We presented here the main patterns of clinical manifestations of migraine found in drawings and the best way to interpret them. Nonetheless, many of the selected studies targeted children and adolescents, limiting the range of their conclusions to this age group. This limitation is, however, a clear opportunity for researchers to evaluate other age strata and possibly even compare them.

The current study highlights the relevance of artwork as an adjunct tool in the clinical diagnosis of migraine given its easy implementation in clinical practice and medical education. The use of drawings has been proposed by many authors to overcome difficulties in making the diagnosis of migraine. It is considered an easy tool to obtain the location and description of pain and its associated characteristics and symptoms, overcoming the limitations related to language skills. Therefore, we

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reiterate the importance of carrying out additional studies with other age groups and populations that have difficulties or limitations in communicating their symptoms through verbal language.

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