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Review

Signs and symptoms of the postictal period in epilepsy: A systematic review and meta-analysis☆

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ABSTRACT

Objective: The postictal period has many physical, behavioral, and cognitive manifestations associated with it. These signs and symptoms are common, can be quite debilitating, and can have a continued impact long after the seizure has ended. The purpose of this systematic review was to quantify the occurrence of postictal signs and symptoms, along with their frequency and duration in persons with epilepsy.

Methods: Cochrane Database of Systematic Reviews, CINAHL, EMBASE, MEDLINE, PsycINFO, Web of Science, and Scopus were searched from inception to November 29, 2017. The Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) reporting standards were followed. Search terms included subject headings and text words such as convulsion, epilepsy, seizure, postictal, post seizure, seizure recovery, seizure end, Todd's paresis, and Todd's paralysis. Standardized forms were used to collect various study variables. Abstract and full-text review, data abstraction, and quality assessment were all done in duplicate. Study heterogeneity was assessed using the I-squared test, and a random effects model was used to determine estimates. Publication bias was evaluated using funnel plots.

Results: From 7811 abstracts reviewed, 78 articles met eligibility criteria, with 31 postictal manifestations (signs and/or symptoms) described and 45 studies included in the meta-analysis. The majority of studies described postictal headaches, migraines, and psychoses, with mean weighted frequency of 33.0% [95% confidence interval (CI) 26.0–40.0], 16.0% [95% CI 10.0–22.0], and 4.0% [95% CI 2.0–5.0], respectively. The mean weighted proportions of manifestations ranged from 0.5% (subacute postictal aggression) to 96.2% (postictal unresponsiveness) with symptom duration usually lasting <24 h but up to 2 months for physical and cognitive/behavioral symptoms respectively.

Significance: Examining data on the various signs and symptoms of the postictal period will have practical applications for physicians by raising their awareness about these manifestations and informing them about the importance of optimizing their prevention and treatment in epilepsy.

1. Introduction

The postictal period is referred to as the period after a seizure has occurred and is associated with various physiological and behavioral symptoms [1–3]. There is currently no concrete and accepted definition of the postictal period. Postictal headaches [4–6], paresis [7–9], aphasia [10,11], coughing [12,13], nose rubbing [13,14], and automatisms [15,16] have all been reported in epilepsy. The symptoms can last for minutes, hours, or even days, and can be debilitating as they can persist

Abbreviations: PRISMA, Preferred Reporting Items for Systematic Reviews and Meta-Analyses; CI, Confidence Interval; EEG, Electroencephalogram; H+, Hydrogen ions; NMDA, *N*-methyl-D-aspartate.

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long after a seizure has ended [4,17]. The social implications of postictal symptoms on the daily lives of individuals also remains unexplored though our team found that postictal behavioral disturbances were associated with depression [18].

Despite the above findings, the postictal period is not well-understood, and research in this area is limited. The underlying physiological mechanisms are still being examined, but some have proposed that lower neuron excitability caused by inhibitory signals, calcium-activated potassium channels, GABA receptors, or other hyperpolarizing receptors, and ion channels may play a role [19]. An animal study found that postictal behavioral deficits occur due to an extended period of hypoxia and hypoperfusion, which characteristically occurred after a seizure, and proposed that the mechanism of action was directly related to COX-2 [20].

The aim of this systematic review was to identify the clinical symptoms and characteristics of the postictal period. Our hypothesis was that postictal manifestations would be common and often severe in persons with epilepsy.

2. Methods

2.1. Protocol and registration

This systematic review was conducted in accordance with the PRISMA statement for systematic reviews and meta-analyses [21]. The protocol was registered with PROSPERO (CRD Registration Number 42016050425), on October 26, 2016.

2.2. Search strategy

Study authors with expertise in epilepsy and a research librarian (D.L.L.) with systematic review expertise developed the search strategy and terms (Appendix A). Cochrane Database of Systematic Reviews, CINAHL, EMBASE, MEDLINE, PsycINFO, Web of Science, and Scopus were all searched from inception to November 29, 2017, with references exported and screened using EndNote X5 [22]. Search terms included subject headings and text words such as convulsion, epilepsy, seizure, postictal, post seizure, seizure recovery, seizure end, Todd's paresis, and Todd's paralysis. To ensure the identification of all relevant studies on this topic, no restrictions were placed on study language, location, or publication date. Additionally, no age restrictions were put in place.

2.3. Study selection

To be eligible for inclusion, the articles needed to fulfill the following criteria: (1) sample size of more than 20 participants; and (2) report either on the signs and/or symptoms of the postictal period in epilepsy. Studies also had to report the proportion of individuals in the study with a particular postictal symptom or sign or had to provide a numerator and denominator for the postictal symptoms of interest. Animal studies, abstracts, and book chapters were excluded. Studies examining only febrile seizures or status epilepticus were excluded since these forms of seizures do not necessarily represent epilepsy [23], as were those examining the postictal period after electroconvulsive therapy, since these seizures were provoked. All five non-English articles (Czech, Russian, Portuguese, German, and Spanish) were translated using Google Translate though for all of them a study author fluent in the language was available to confirm correct translation [24]. A kappa statistic was calculated at the full-text stage to determine reviewer agreement [25].

Abstracts were screened independently and in duplicate by two reviewers (A.S. & S.K.). A third reviewer (epilepsy expert, N.J.) examined all abstracts that were selected for full-text review to ensure that they were relevant. Two reviewers also independently screened the full-text articles (A.S. & S.K.). The reference lists of the included articles, and the reference lists of any relevant reviews and systematic reviews, were manually searched for additional relevant studies. Disagreements on the inclusion of articles were resolved by consensus. If consensus could not be reached, a third reviewer (N.J.) resolved the disagreements.

2.4. Data extraction and study quality

Data were abstracted by one reviewer and checked by a second reviewer (A.S. & S.K.). If articles examined the same populations, additional articles were only included if they provided additional data (e.g., stratified results). Standardized forms were created to extract the following variables: study design, study sample size and location, method of data collection, study sample demographics (age, sex distribution, epilepsy type, and severity), the diagnostic criteria used to assess the postictal symptoms and/or signs and the cases of epilepsy, antiepileptic drug use in the study sample, and all reported postictal symptoms and/or signs. If provided, the range of the duration for the postictal manifestations was also collected. Stratification by epilepsy type, seizure type, sex, and age were also collected when provided.

2.5. Assessment of study quality

The National Heart, Lung, and Blood Institute's Quality Assessment Tool for Observational Cohort and Cross-Sectional Studies, a 14-item quality assessment tool, was used to evaluate study quality [26]. This tool assesses the research question, study design, sample size, eligibility criteria, measure and exposure quality, outcome measures, blinding of outcome measures, follow-up rate, and statistical analyses. The tool can be found in Appendix B.

2.6. Data synthesis and analysis

All decisions regarding the statistical analyses were made prior to the start of the study. Descriptive statistics were used to assess the proportion of individuals who experienced postictal signs and/or symptoms. The decision to use a random effects model was made a priori to account for expected study heterogeneity, which was assessed using I-squared test [27], and funnel plots were created to visually examine for the presence of possible publication bias. Meta-analyses were conducted using STATA [28].

3. Results

3.1. Study selection

The database searches identified 7811 unique abstracts, of which 123 addressed postictal signs and symptoms and were pulled for full-text screening. (Fig. 1). Seventy of these articles and eight additional articles identified through hand searching met the inclusion criteria. The agreement between the two reviewers was 84.3% at the full-text review stage. Reasons for study exclusion are outlined in Fig. 1; most commonly, the articles, while addressing the postictal period, did not report a proportion or the numerator and denominator for the postictal sign and/or symptoms described. In the end, 45 studies were included in the meta-analyses (27 articles reporting postictal headache, 16 reporting postictal migraine, and 13 articles reporting postictal psychosis). The reference list of all the included articles can be found in Appendix C.

3.2. Study characteristics

Of the 78 included studies, the majority of studies reported on postictal headache (31), followed by migraine (16), aphasia (7), paresis (10), nose rubbing/face wiping (6), and coughing (4). The majority of data collection was done via questionnaires, in person or telephone interviews, or through video-electroencephalogram (EEG) recording analysis. Detailed study characteristics, including population examined,

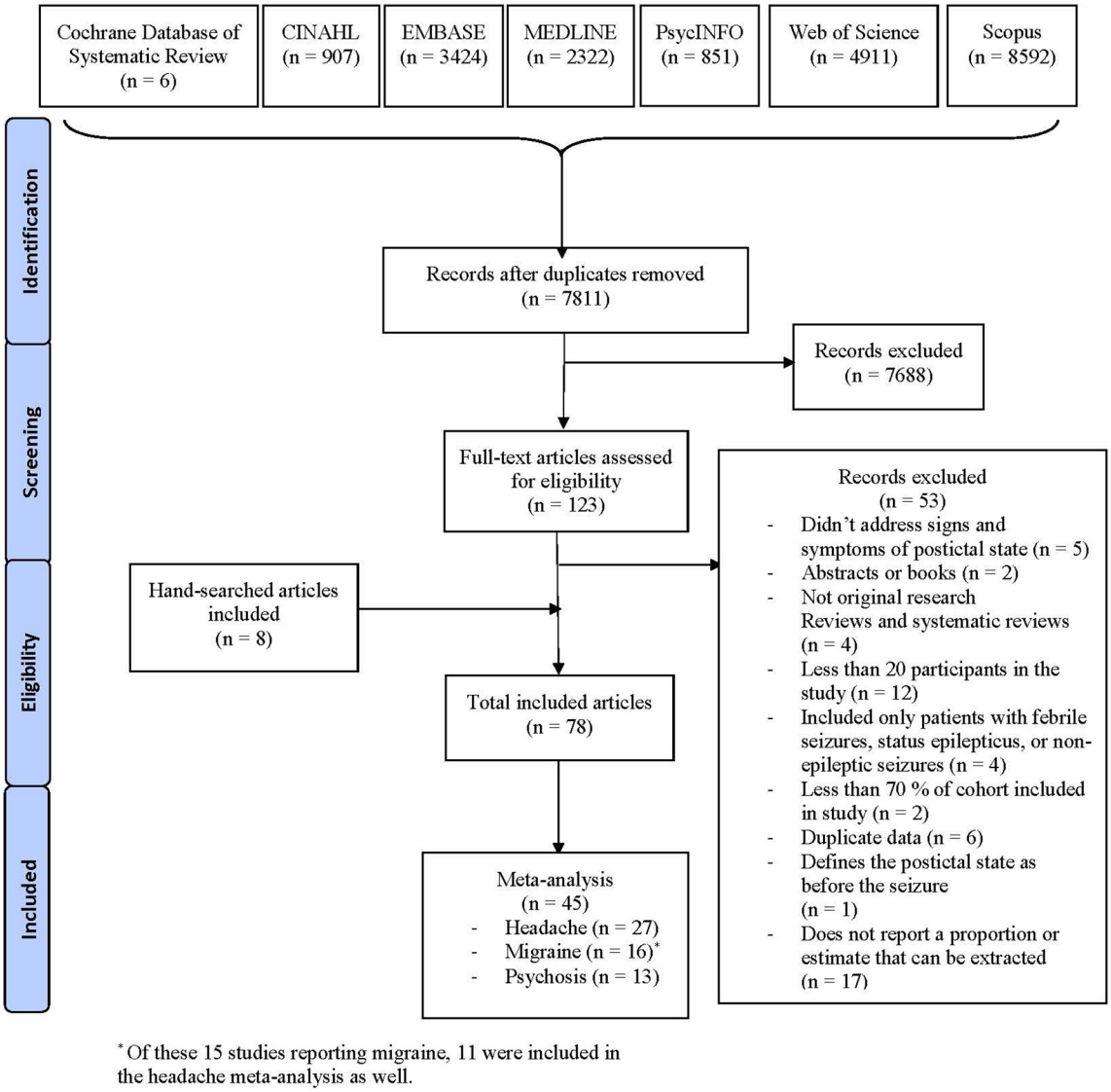

Fig. 1. PRISMA flow diagram.

sample size, age range and mean age, data source, how epilepsy diagnosis was obtained, diagnostic criteria used of epilepsy and postictal symptoms, years of data collection, and estimates of postictal signs and symptoms, can be found in Appendix D (studies reporting on postictal headache) and Appendix E (studies reporting on other postictal symptoms).

3.3. Study quality

The results of the quality assessment for the included studies can be found in Appendix F. Most of differences in study quality occurred because of the presence or absence of well-defined diagnostic criteria for both postictal signs and symptoms and for epilepsy. Furthermore, the majority of studies were not blinded because of the nature of the data being collected. No included studies examined potential confounding variables, such as age or sex.

3.4. Postictal signs and symptoms summary

The number of articles reporting on a particular postictal sign and symptom, along with the mean weighted proportions are displayed in Table 1. The mean weighted proportions range from 0.5% (postictal subacute aggression) to 96.2% (postictal unresponsiveness). A variety of postictal signs and symptoms were identified, typically physical signs and symptoms (i.e., coughing, paresis, automatisms) and/or cognitive and behavioral signs and symptoms (i.e., wandering behavior, unresponsiveness, depression, psychosis, cognitive impairment, aphasia). The mean postictal headache duration was 14 h (n = 3 studies). The range of postictal symptom duration varied from 3 s in the case of general automatisms in one study to 296 h (about 12.3 days) for postictal depression and postictal anxiety in another study. Lastly, postictal psychotic symptoms ranged from 2 min to 2 months [29].

3.5. Meta-analysis of postictal headache

There were 31 articles reporting on the proportion of individuals that experienced postictal headaches. Twenty-seven such articles were included in the meta-analysis, with four articles excluded for reporting overlapping duplicate data (3) or only the proportion of individuals with postictal migraine specifically and not postictal headache overall (1). In cases of overlapping duplicate data, the article that examined a larger sample size was included in the meta-analysis. The mean weighted overall estimate for the proportion of individuals that experienced postictal headache was 33.0 out of 100 (95% confidence interval [CI] 26.0–40.0) (Fig. 2). Stratifications were done based on studies reporting on only pediatric populations (all participants were 17 years

Table 1
Summary statistics of postictal symptoms.

Postictal symptom	Number of papers reporting symptom and/or signs	Number of papers included in analyses[a]	Total number of people examined	Mean weight out of 100 (CI)	Duration range	Comments
Headache	31	27	6126	33.0 (26.0–40.0)	1.8 min to 96 h	One study reported postictal headache occurring after every seizure in 66.4% of patients Headache severity: The majority of patients experience mild and moderate headaches, with fewer individuals experiencing severe headaches Mean Headache Duration = 14 h
-Pediatric	12	6	547	33.0 (15.0–52.0)		
-Adult	15	9	2807	29.0 (17.0–41.0)		
-All Ages	12	12	2772	36.0 (25.0–46.0)		
Migraine	16	16	4311	16.0 (10.0–22.0)		
-Pediatric	5	5	685	23.0 (2.0–43.0)		
-Adult	6	6	2371	16.0 (8.0–24.0)		
-All Ages	5	5	1255	9.0 (6.0–12.0)		
Tension Type	6	6	1377	13.0 (9.0–17.0)		
Aphasia	7	7	1403	34.0 (8.0–59.0)	–	
Impaired Language	1	1	84	38.1	–	
Paresis	10	9	1553	10.0 (5.0–15.0)	2 min to 36 h	
Oral Automatisms	1	1	160	31.9	–	
Genital Automatisms	4	4	688	6.0 (2.0–11.0)	–	
Nose Rubbing/Face Wiping	6	5	547	48.0 (23.0–73.0)	–	
General Automatisms	1	1	55	61.8	3 s to 110 s	
Hypersalivation	1	1	112	2.7	–	
Coughing	4	3	315	31.0 (0.0–62.0)	–	
Laughter	1	1	67	1.5	–	
Sighing	1	1	67	11.9	–	
Leaving Behavior/Wandering	2	2	165	11.0 (7.0–16.0)	13 s to 115 s	
Cognitive/Behavioral Impairment	1	1	1510	72.1	–	
Cognitive Impairment	1	1	100	82.0	–	
Neurovegetative Symptoms	1	1	100	62.0	–	
Hypomanic	1	1	100	22.0	10 min to 48 h	
Fatigue	1	1	100	37.0	10 min to 108 h	
Drowsiness	1	1	112	42.0	–	
Sleep	1	1	112	6.3	–	
Unresponsiveness	1	1	26	96.2	–	
Confusion	2	2	148	16.0 (12.0–21.0)	1 min to longer than 5 mins	
Sphincter release	1	1	112	13.4	–	
Vomiting	1	1	112	7.1	–	
Anorexia	1	1	112	2.7	–	
Depression	1	1	100	43.0	10 min to 296 h	
Anxiety	1	1	100	45.0	10 min to 296 h	
Psychosis	13	13	4757	4.0 (2.0–5.0)	2 min to more than 15 h but less than 2 months	
Crying	1	1	112	8.0	–	
Irritability	1	1	112	2.7	–	
Subacute aggression	1	1	1300	0.5	–	

CI, Confidence interval; h, Hours; min, Minutes.
[a] Duplicate data excluded (Studies examining the same population done by the same author in the same year).

of age or younger), and those studies reporting on only adults (all participants were 18 years of age or older). The overall estimate was 29.0% (95% CI 17.0–41.0) for postictal headache in the adults (n = 9 studies), 33.0% (95% CI 15.0–52.0) in the pediatric population (n = 6 studies), and 36.0% (95% CI 25.0–46.0) for postictal headache in populations including all ages (n = 12 studies). There was significant statistical heterogeneity present in these studies stratified by age group (Adult $I^2 = 98.41$, $p < 0.001$; all ages $I^2 = 97.67$, $p < 0.001$; pediatric $I^2 = 96.15$, $p < 0.001$).

3.6. Meta-analysis of postictal migraine

Sixteen articles reported on the proportion of individuals that experience postictal migraines. All 16 articles were included in the meta-analysis. The mean weighted overall estimate for the proportion of individuals that experienced postictal migraine was 16.0% (95% CI: 10.0–22.0) (Fig. 3). As with postictal headache, stratifications were done based on pediatric and adult populations with the same age restrictions stated above. The overall mean weighted estimate was 16.0% (95% CI 8.0–24.0) for migraine in adults (n = 6 studies), 23.0% (95% CI 2.0–43.0) in children (n = 5 studies), and 9.0% (95% CI 6.0–12.0) in studies including all ages (n = 5 studies). As with postictal headache estimates, there was significant statistical heterogeneity present when postictal migraine was stratified by population age (Adult $I^2 = 96.60$, $p < 0.001$; all ages $I^2 = 64.76$, $p < 0.02$; pediatric $I^2 = 98.83$, $p < 0.001$).

3.7. Meta-analysis of postictal psychosis

All 12 articles that reported on postictal psychosis were included in the meta-analysis. The mean weighted overall estimate for the proportion of individuals that experienced postictal psychosis was 4.0% (95% CI 2.0–5.0) (Fig. 4). All the articles describing postictal psychosis examined adults and did not report on any potential subgroup; therefore, no further stratifications could be done. There was also significant statistical heterogeneity present among these studies ($I^2 = 85.43$, $p < 0.001$).

3.8. Publication bias

Three separate funnel plots were created using proportions to assess publication bias in the articles addressing postictal headaches, postictal migraines, and postictal psychosis (Figs. 5–7). A visual assessment indicated a slightly uneven distribution of the postictal psychosis papers, suggesting that there was some, albeit minimal, publication bias. There was more publication bias present in the postictal headache and postictal migraine dataset.

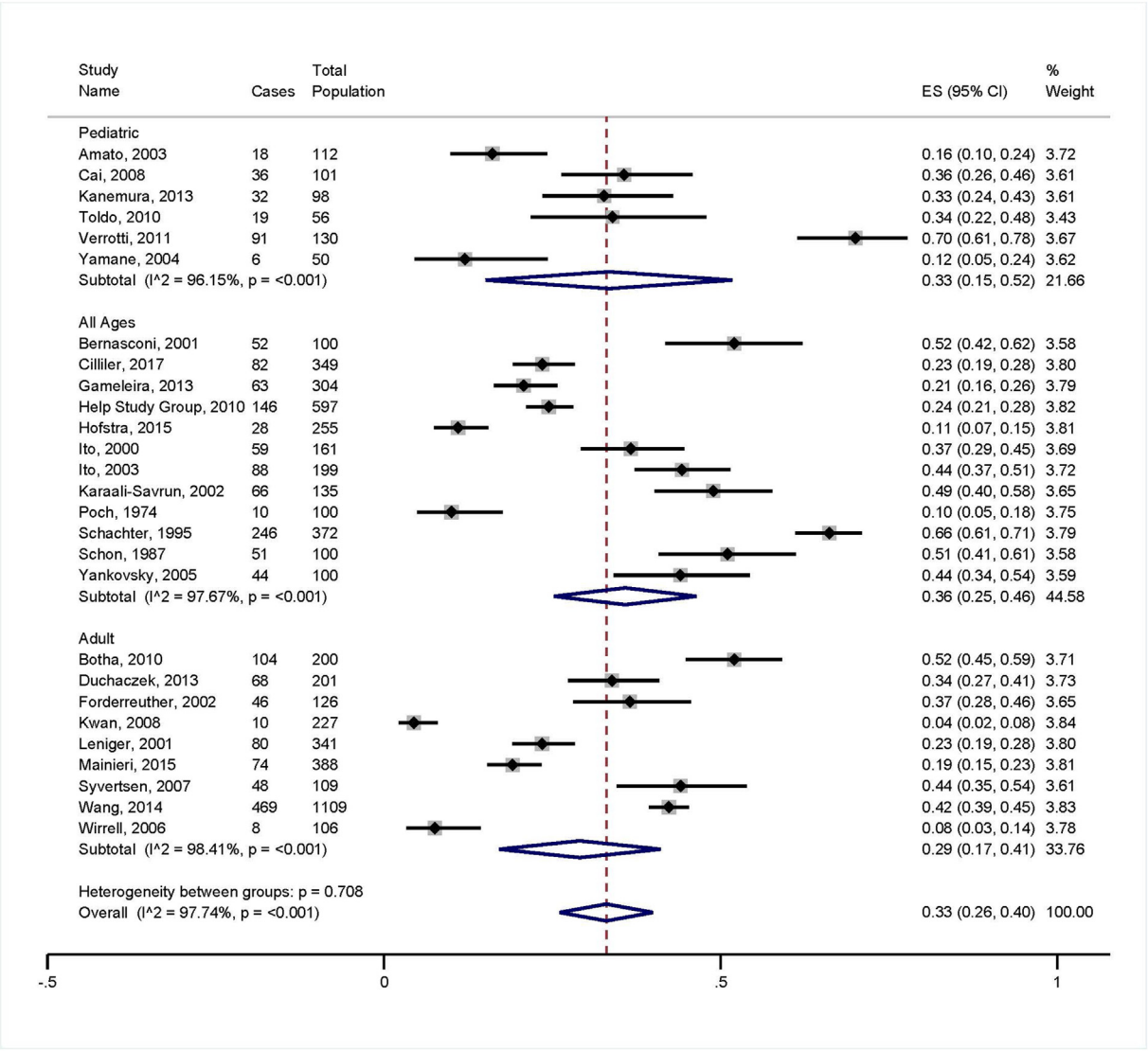

Fig. 2. Forest plot of studies reporting overall postictal headaches.

4. Discussion

In the 78 articles included in this study, a variety of postictal symptoms were examined. The majority of studies described postictal headaches, migraines, and psychoses; the mean weighted frequency of these symptoms was 33.0%, 16.0%, and 4.0% respectively. These estimates are possibly generalizable to individuals with epilepsy of any type, as many of the studies included various epilepsy types and/or syndromes. Other frequently reported symptoms identified in our systematic review included aphasia (34.0%), paresis (10.0%) nose rubbing/face wiping (48.0%), and coughing (31.0%). These estimates are however not generalizable because the majority of studies examining these signs were in people with focal epilepsies. There were fewer articles that examined cognitive and behavioral symptoms such as leaving/wandering behavior (11.0%), confusion (16.0%), depression (43.0%), and anxiety (45.0%).

4.1. Postictal headaches and migraines

Postictal headaches and migraines occurred frequently in both children and adults, with both headaches and migraines occurring more often in children than in adults (headaches 33.0% vs 29.0%), (migraines 23.0% vs 16.0%). One interesting finding from the Help Study Group, whose findings were included in this systematic review, is that in the 97/146 individuals (66.4%) who experienced postictal headaches in their study, the headaches occurred after every single seizure [4]. If this trend were to hold true across other studies, it would suggest that postictal headache may be a considerable impairment to those who experience it, especially if they are experiencing frequent seizures.

Worldwide, around 46% of adults have an active headache disorder [30]. This is higher than the frequency of individuals that experienced postictal headaches in this systematic review (26.1%). Next, the prevalence of migraine in the general population was found to be 11.6% in a recent systematic review of 302 community-based studies [31,32]. This is comparable to the findings of this systematic review, where the occurrence of postictal migraine was 16.0% overall, but these estimates are not comparable since the prevalence of interictal migraine was not investigated in this systematic review. Furthermore, it is well-known that women are three times more likely to experience migraines when compared with men [33,34]. The one study that stratified postictal migraine occurrence by sex in this systematic review found the opposite, with postictal migraines occurring more often in men than women [35].

Several studies have been conducted on potential treatments for postictal headaches. One article reported on flunarizine as a treatment for postictal headaches. Of the 14 patients that experienced postictal headaches, 13 reported symptom relief to some degree after flunarizine

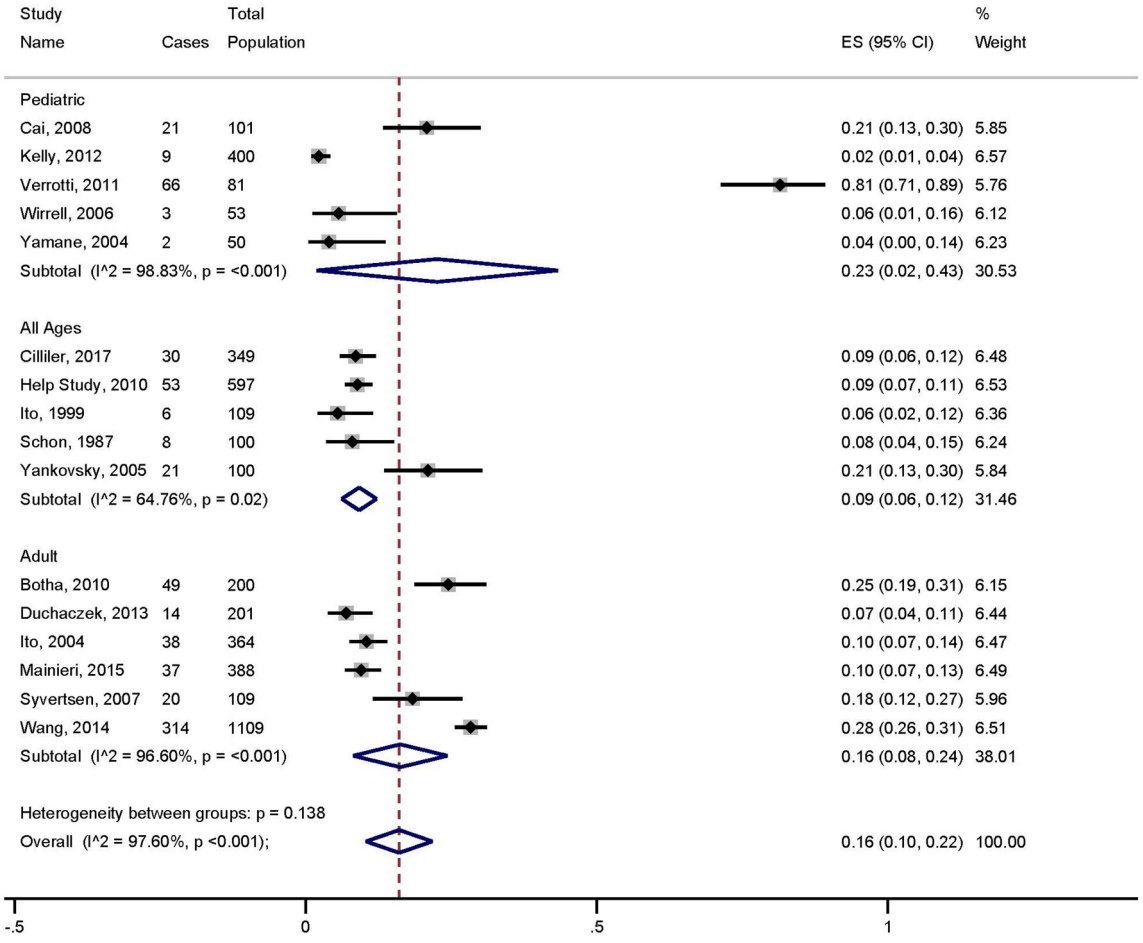

Fig. 3. Forest plot of studies reporting overall postictal migraine.

intake [36]. Furthermore, a case study that looked at sumatriptan as a treatment for postictal migraines reported that both patients experienced shortening in the duration of their postictal migraine with this medication [37].

4.2. Postictal psychosis and other psychiatric symptoms

The rarest symptom identified in this systematic review was subacute postictal aggression (0.5%) [38]. This is not surprising as individuals with epilepsy rarely display intentional violence after a seizure [39,40]. Moreover, a large cohort study examining the occurrence of psychosis in the general population in Finland reported a lifetime prevalence of 3.1% for all psychotic disorders [41]. This systematic review found that postictal psychosis occurred in 4.0% of individuals postictally, suggesting that the lifetime occurrence of psychosis may be even higher in those living with epilepsy, since interictal psychosis and ictal psychosis were not investigated.

The duration of the postictal period has always been difficult to quantify. While many of the postictal symptoms tend to last less than 48 h (paresis [9], general automatisms [16], leaving/wandering behavior [42], and confusion [43]), many of the cognitive symptoms last much longer. For example, in one study included in this systematic review, postictal fatigue and postictal depression were reported to last anywhere from 10 min to 296 h (~12 days) [44]. Of the individuals who experience postictal agoraphobic symptoms, 96% reported that their agoraphobia was directly related to their fear of having another seizure in public [17]. Many postictal psychosis studies examined psychotic episodes longer than 15 h but less than 2 months [29,45,46]. Furthermore, postictal psychiatric symptoms tend to be far more extreme than physical postictal impairments. In extreme cases, suicide [46] and homicide [47] (both due to bouts of postictal psychosis) and limb amputation [48] have occurred. Clearly, heightened awareness, identification, and management of postictal psychiatric symptoms by clinicians is extremely important to ensure the best possible patient care and prevent potentially devastating events.

Interventions for postictal psychosis, which have been reported as particularly helpful include social support networks, close observation, and sedatives such as benzodiazepines or chloral hydrate [49].

4.3. Postictal paresis and aphasia

The proportion of individuals with focal epilepsy who experienced postictal paresis and aphasia were 10.0% and 34.0%, respectively in this systematic review with duration of postictal paresis ranging from 2 min to 36 h, while no duration time was reported for postictal aphasia. Postictal paresis and aphasia can easily be mistaken as a sign of stroke, and vice versa. One study found that 10 out of 209 cases initially diagnosed as epileptic events were strokes [50]. Clearly differentiating between these two diagnoses (postictal paresis or aphasia vs stroke) is critical since their management is so vastly different. Furthermore, an article examining the effects of periictal interventions on postictal generalized EEG suppression and postictal immobility reported promising results. The earlier the nursing interventions (i.e., oxygen administration, suctioning, and repositioning) occurred during the periictal phase, the shorter the duration of hypoxemia and postictal generalized EEG suppression [51]. Seizure and convulsion duration decreased when earlier interventions were implemented [51].

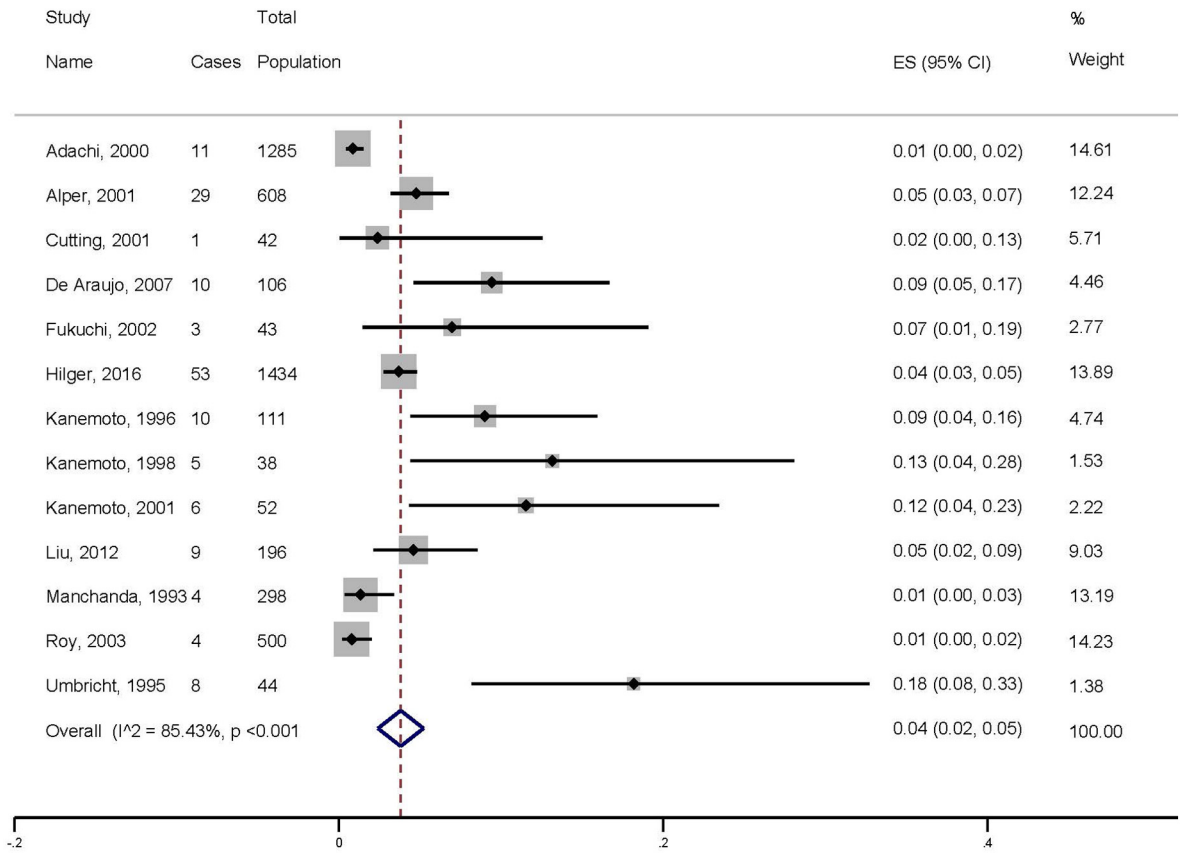

Fig. 4. Forest plot of studies reporting overall postictal psychosis.

4.4. Postictal cognitive and behavioral signs and symptoms

Ten articles examined some form of postictal cognitive and/or behavioral dysfunction (i.e., drowsiness, confusion, irritability, subacute aggression, unresponsiveness, etc.). The most common of these were postictal cognitive or behavioral impairments (72.1%) [18], postictal cognitive impairment (82.0%) [44], and postictal unresponsiveness (96.2%) [52].

Unfortunately, studies examining these signs are scarce and none reported on the duration of postictal cognitive or behavioral impairment, likely because impairment occurs after seizures so frequently, and it may often not the most serious complication. We cannot provide clear statements about frequency or duration of this most important postictal feature due to the heterogeneity of the studies done on this topic and the scarcity of data. We hope this systematic review will encourage researchers to further examine the duration of these common impediments and possible interventions to reduce them if disabling and prolonged.

4.5. Neurobiological basis/pathophysiology of postictal signs and symptoms

Recently, more studies have examined the potential biological mechanisms behind the postictal period. It has been suggested that the drastic muscle contractions that occur in generalized motor-onset

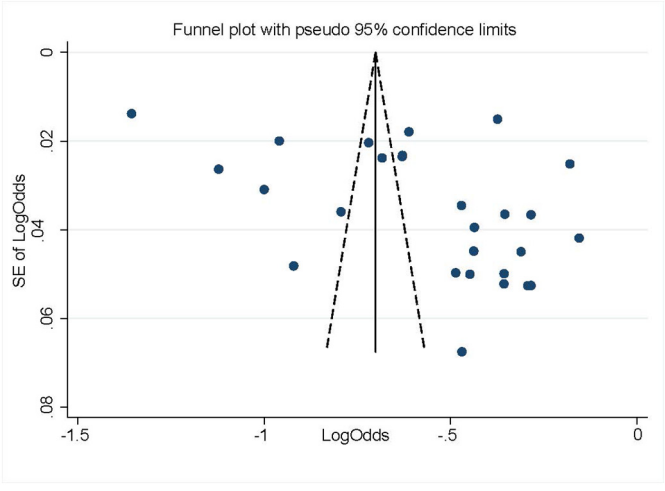

Fig. 5. Funnel plots of studies reporting overall headache.

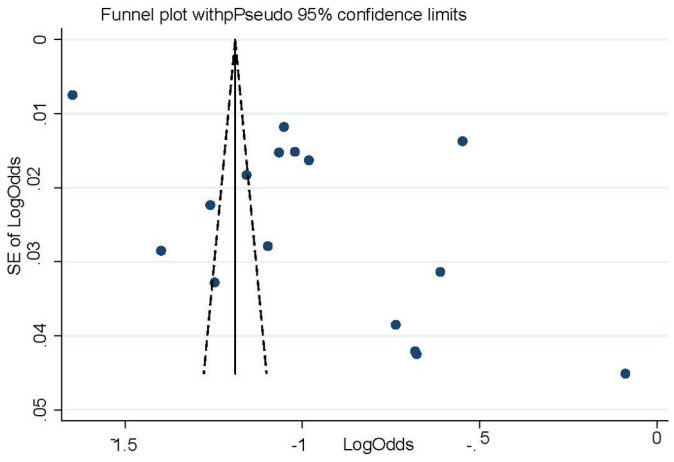

Fig. 6. Funnel plots of studies reporting overall migraine.

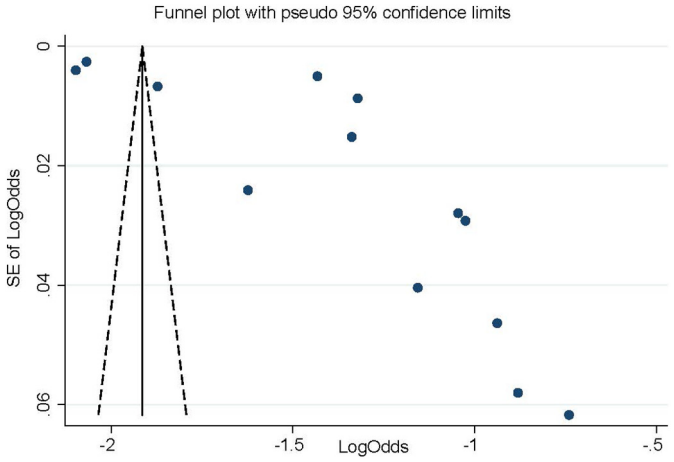

Fig. 7. Funnel plots of studies reporting overall psychosis.

seizures could cause the muscles to start using anaerobic metabolism because of oxygen deprivation. This in turn leads to lactic acidosis, and these excess H^+ ions could potentially disrupt the normal functioning of ion channels that interact with *N*-methyl-D-aspartate (NMDA) by dampening its normal effects, again leading an increased neuronal excitability threshold [19]. One major caveat noted was that the inhibitory effects caused by neuronal ion channels and lactic acidosis are relatively short-lived, and that these mechanisms cannot explain the longer duration of postictal impairment in patients in the hours and days following a seizure [19]. Another study done by members of our team found that severe hypoxia occurs after seizures, which is mediated by hypoperfusion, and which is localized to the areas of the brain where the seizures originate [20]. Specific postictal memory and behavioral impairments in that study were found to be caused by these hypoperfusion/hypoxic events [20]. Importantly, many commonly prescribed antiseizure medications (e.g., topiramate, phenobarbital, levetiracetam, valproate) do not inhibit postictal hypoxia, and therefore provide no protection from commonly seen postictal impairments [20].

4.6. Study limitations

Many of the included articles were not focused specifically on capturing postictal data. Instead, the main goal of these articles was to capture other ictal or periictal data, and they also reported data on postictal signs or symptoms as secondary outcomes. Furthermore, some articles that did contain specific data on the postictal period had to be excluded from this systematic review since they reported test scores without providing a score that indicated significant impairment, or values were reported out of seizure number, not out of the number of patients examined. The sample size for many postictal signs or symptoms was often very small, which entails greater uncertainty with regard to their true frequency. Because of the significant statistical heterogeneity present among the included studies, stratification was not done by seizure type. Additionally, the reported overall mean weighted proportions for the occurrence of postictal aphasia, paresis, nose rubbing, and coughing are more applicable to individuals who have focal epilepsy as the majority of studies examining these symptoms looked at those with focal epilepsy. Finally, there has been limited research on potential interventions for the various postictal signs and symptoms. Much of the research in this area has been done in animals [20,53]. The examined interventions were invasive and would therefore be of limited usefulness in a clinical setting. It remains to be seen if continuous prophylactic treatment for headache, migraine, psychosis, and other psychiatric manifestations would decrease the severity of these postictal symptoms without important adverse effects.

5. Conclusion

The postictal period is associated with many physical, behavioral, and cognitive signs and symptoms. These manifestations are fairly common, can be debilitating to individuals, and can have a prolonged impact long after the seizure has ended. It is important to continue to quantify the frequency of these signs and symptoms, as well as to examine the potential biological mechanisms that underlie them. More extensive research is needed to examine potential treatments and interventions that can alleviate the disability caused by these various postictal symptoms.

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Declaration of interest

None.

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