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New-onset epilepsy in the elderly

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Abstract:
People who are 60 years old and older have the highest incidence of developing new-onset epilepsy. The increase of the ageing population has resulted in a greater number of patients with new-onset epilepsy or at risk of developing the condition. Previously published review articles regarding epilepsy in older patients have had a broad focus, including people who were diagnosed with epilepsy in childhood or in middle age. This review focuses on the causes, treatment, prognosis and psychosocial impact of *new-onset* epilepsy in people aged 60 years and over. Following a search of the medical electronic databases and relevant references, we identified 22 studies overall that met the inclusion criteria. Only four randomised clinical trials (RCTs) were identified comparing different antiepileptic drug treatments in this population, demonstrating that newer generation antiepileptic drugs, e.g. lamotrigine and levetiracetam, were generally better tolerated. One uncontrolled study provided promising evidence of good outcomes and safety for surgical resection as a treatment for people with uncontrolled seizures. Five studies reported that people 60 years and over with new-onset epilepsy have significant cognitive impairments, e.g. memory, and psychological issues including depression, anxiety and fatigue. We found that there is very limited evidence to guide treatment in people with Alzheimer's disease and epilepsy. The specific features of new-onset epilepsy in this target population significantly influences the choice of treatment. Cognitive and psychiatric screening before treatment may be useful for management. Two studies with proposed guidelines were identified, but no formal clinical practice guidelines exist for this special population to assist with appropriate management. There is a need for more RCTs that investigate effective treatments with limited side effects. More research studies on the psychosocial effects of new onset epilepsy, and long-term outcomes, for people aged 60 years are also required.

Key words: new-onset epilepsy, elderly, treatment, antiepileptic drugs, randomised controlled trials, psychosocial

1) Introduction

By the end of 2015, half of new-onset seizures in Australia were estimated to be in older patients or people 60 years old and older [1]. With the ageing population, the number of people aged 60 years and over in the community who are diagnosed with new-onset epilepsy has increased significantly. A pivotal early study from the USA (Rochester, Minnesota) showed that the incidence of new-onset epilepsy increases with age from 28 per 100,000 at 50 years old, to 40 per 100,000 at 60 years old and 139 per 100,000 at 70 years old [2]. Another recent large study from Finland demonstrates the increasing incidence of new-onset epilepsy in people 60 years or over with time, from 57 per 100,000 in 1973 to 217 per 100,000 in 2013, an almost 5 fold increase [3]. The likelihood of developing epilepsy in people older than 80 years old is three times higher than that in children [4]. The hospitalisation rate of people 60 years or more with new-onset epilepsy is three times higher in comparison to people with chronic epilepsy (52% vs 15%) [5]. Not only is the hospitalisation rate high, but mortality is too, with a recent population-based study that reported a standardised mortality ratio of 3 – 20 among those with the condition [6]. This indicates not only an important issue for the clinical setting, but also a significant public health issue particularly with more people living longer due to advancements in medical treatment [7].

The most common risk factors for the development of epilepsy in people 60 years old and over include increasing age, metabolic or toxic factors (e.g. drugs or excessive amounts of alcohol) and depression. The increased prevalence of new-onset seizures in people aged 60 and over is due to several factors associated with this special population (apart from the increase in ageing population), including co-existing conditions (or comorbidities) such as cerebrovascular diseases (e.g. stroke), high blood pressure, diabetes and dementia [8]. These comorbidities are frequent in people 60 years and over and for this reason are a very important consideration in their management of new-onset epilepsy.

In comparison to younger age groups, the type of new-onset epilepsy experienced in people aged 60 years and over are most commonly *focal seizures with impaired awareness* (previously called complex partial seizures) with or without secondary evolution to generalised bilateral tonic-clonic seizures [7]. The seizures are often shorter in duration with less overt clinical features and symptoms, which may be masked by cognitive impairments, or other neurological conditions, and therefore can be more difficult to identify and diagnose (Table 1). The diagnosis may take some time before it is considered, let alone confirmed, in many cases, which means appropriate treatment is commenced later than it should. However, there is a high possibility of seizure remission in older people who have earlier detection and response to treatment, facilitating better long-term outcomes.

Table 1: Differential diagnosis - common symptoms that can present clinically like new onset seizures or post ictal confusion [12,13]

Treatment can also be challenging in people aged 60 years and over as they generally suffer from 1) a decreased capacity to metabolise drugs, 2) an increasing sensitivity to cognitive and neurological effects of drugs, and 3) commonly take multiple medications [8]. Newer generation antiepileptic drugs, such as lamotrigine, levetiracetam and gabapentin may be better tolerated and have less drug-to-drug interactions, and hence are more commonly used for new-onset epilepsy in people 60 years and over than older generation antiepileptic drugs, such as carbamazepine or phenytoin [9, 10]. However, there is a lack of well-conducted clinical trials for effective antiepileptic drugs for treating new-onset epilepsy in people 60 years and over to act as a guide for treating health professionals.

Over the last 5 - 10 years, there have been several reviews published on epilepsy in people aged 60 years and over (incorporating those who developed the condition in childhood or middle age), however only a small number have focused specifically on *new-onset epilepsy* in the elderly [11, 12, 13]. Although one of these

reviews was only published a couple of years ago, its focus was only on causes and not on treatment and the psychosocial impact. Therefore, the objective of this review is to update the limited existing evidence for the causes, treatment and psychosocial impact of new-onset epilepsy in people aged 60 years and over.

Methods

We searched the following electronic medical databases - MEDLINE, EMBASE and the Cochrane Library from Jan 1, 1990, to September 1, 2017 using the following search terms "new-onset", "newly diagnosed", "epilepsy", "causes", "prognosis", "EEG", "imaging" AND "elderly".

Eligibility criteria

People aged 60 years or over with a diagnosis of new-onset epilepsy were included. If the study did not specify that it included new-onset epilepsy or the age of diagnosis, we excluded it. We excluded people aged 60 years and over who developed the epilepsy at a younger age, as this does not meet the definition of being new-onset. We also excluded studies that exclusively involved veterans who were 60 years and over as this is a specific population, which may be skewed towards males and may not be generalisable to other populations such as all people in the community. All study types (both qualitative and quantitative studies) were included except for reviews. Only studies that looked at the causes, prognosis (outcomes), treatment and psychosocial impact were included. Language was restricted to English. The searches were also supplemented with manual searches of the reference lists of all included studies and references provided by experts in the topic area. All titles and abstracts of studies were screened using the pre-determined eligibility criteria by authors LV and LP. Data was extracted from the studies according to the study design, number of participants, type of epilepsy, main findings and type of treatment studied. Following extraction, the data were analysed and summarised narratively.

2) Results:

Overall, we identified 22 studies that met the inclusion criteria. We identified two possible guidelines for the treatment of epilepsy in people aged 65 years and older [14, 15] and one systematic review looking at the treatment of epilepsy for people with Alzheimer's disease [16]. We also identified a protocol for a systematic review and meta-analysis of the medical treatment [16].

One of the guidelines identified was based on the results from a consensus meeting of epileptologists held in Belgium in 2004 in relation to the management and treatment of epilepsy in older people. The guideline proposed three key recommendations [14] –

1. 'We propose to do a sleep or a nap EEG recording if the awake EEG is negative (page 111).'
2. 'We propose to treat after a first unprovoked seizure in the presence of a brain lesion or epileptiform abnormalities. For a first unprovoked seizure of unknown origin, the decision to treat should be individualised, after the evaluation of the vital risk induced by comorbidities, the increased risk of status epilepticus in elderly population, the risk of serious injuries especially bone fracture in osteoporotic patients, and the potential adverse events of antiepileptic drugs (page 112).'
3. 'In first line treatment and due to the adverse events of previously described old AEDs we recommend the use of valproate if a rapid titration or an intravenous use is necessary (page 114).'

The proposed guideline provided an algorithm for helping clinicians to decide on whether it is appropriate to treat after a first seizure and how to choose the most appropriate antiepileptic drug for treatment. The authors also reported that 'there is very few evidence based data on the use of these drugs in older patients, especially in the very old and in elderly with co-disease(s) (page 112)' [14].

The second guideline identified is an operational 'good practice guide' produced by a guideline development group in Scotland using evidence from the literature, expert opinion and consultation with clinicians and

patients [15]. The guide provides recommendations for obtaining a witness history, options for identifying possible suspected epilepsy, a referral algorithm, recommendations for starting treatment and choosing the right one, and key considerations for other aspects of patient care including psychosocial impacts, driving and models of care.

A systematic review looking at the treatment of epilepsy in people with Alzheimer's disease (AD) only identified one randomised controlled trial involving a small group of 95 people [16]. The trial involved a comparison of three antiepileptic drugs – levetiracetam, lamotrigine and phenobarbital, however no significant difference in seizure freedom was found for any of the treatments. Levetiracetam was found to improve cognition in people with epilepsy and AD, however lamotrigine and phenobarbital had the opposite effect. Lamotrigine was found to improve depression, however phenobarbital and levetriacetam worsened mood. The authors reported the evidence identified was very low and should not be generalised to the target population.

A protocol for a systematic review and meta-analysis on the safety and effectiveness of medical treatment of epilepsy in older patients was identified [17]. Preliminary results have been reported at a national annual meeting in America [18], however the full results are not yet available. The review found 10 studies for inclusion in their analysis involving 938 patients. The authors concluded that lamotrigine and levetiracetam were as effective as other antiepileptic drugs and were better tolerated. Levetiracetam was found to be more effective than lamotrigine, however it had a greater increased risk of side effects. There is also some evidence to support the effectiveness of brivaracetam, perampanel and topiramate. Topiramate was also found to be effective and well tolerated in older people with uncontrolled seizures. Further studies are required to provide evidence of the best possible treatment in new-onset epilepsy in people 60 years and over.

Clinical assessment and prognosis of new-onset epilepsy in older people

Four studies were identified that assessed the clinical characteristics of older people presenting with new-onset epilepsy [19, 20, 21, 22]. The number of patients in each study ranged from 70 to 1848 (one study did not provide any details). The type of epilepsy provided as a diagnosis was mostly similar across studies, with the most common type being focal seizures, however one of the studies reported mixed types including status epilepticus and structural epilepsy, especially in the late onset group [19]. The main cause identified by two of the studies was stroke, ranging in prevalence from 16% - 38% of participants [19, 20] and Alzheimer's disease in one study, 10-22% [24]. Dementia was reported as the second highest cause in one study with 10% [20]. Four studies were identified which reported on the prognosis of new-onset epilepsy in older people [25-28]. The length of follow up for all of the studies ranged from 2.7 years - > 20 years. Seizure freedom using antiepileptic drugs with achieved by most patients in all four studies (range - 60% - 92%) [25-28].

Antiepileptic drugs for new-onset epilepsy in older adults

Table 2 provides an overview of the randomised clinical trials that were identified to compare the effectiveness and tolerability of different AEDs as monotherapy in older patients [9, 10, 29, 30]. Overall, they all show that the effectiveness in controlling seizures is comparable between new AEDs, such as lamotrigine, topiramate, and levetiracetam, and older antiepileptic agents, such as carbamazepine. However, the newer drugs resulted in less adverse effects and have higher tolerability and retention rates than older generation drugs, such as carbamazepine.

Table 2: randomised double blind clinical trials comparing the effectiveness and tolerability between old antiepileptic drugs and new antiepileptic drugs in older patients with newly diagnosed epilepsy

Surgery for new-onset epilepsy in the older patients

Resective surgery can be another treatment option for epilepsy in older patients, in particular for drug-resistant or difficult to treat seizures due to drug-to-drug interactions for coexisting conditions. A retrospective study of patients over 60 years of age with new-onset focal epilepsy using the surgical database at the University of California (UCLA) from 1998 to 2013 was identified in the current review [31]. Dewar et al (2016) showed that a good postsurgical outcome (Engel Class I–II) was achieved for 11 out of 12 patients (91.7%) and half of the patients (6 of 12 patients) were completely seizure free (Engel Class IA) at the end of follow-up period (mean 3.1 ± 2.1 years). All patients had at least one medical comorbidity in addition to epilepsy. The authors reported that resective surgery for epilepsy in patients 60 years and older is safe and effective for most patients.

Neuropsychological and psychiatric comorbidities

We identified in total five studies that investigated the neuropsychological and psychiatric comorbidities of new-onset epilepsy in the elderly [32-35]. Two of the studies looked at cognitive functioning of people 60 years or over with new-onset epilepsy [32, 33]. An early case-control study involved people 60 years or over with new-onset focal epilepsy who were on anti-epileptic drug treatment (40 participants) and compared their cognitive functioning to healthy controls of the same age group using a battery of neuropsychological tests [32]. The authors reported that people 60 years or over with new-onset focal epilepsy had significantly impaired cognitive functioning in comparison to controls indicated by poorer scores on neuropsychological testing. Further analysis revealed that the use of polytherapy was associated with impaired cognitive functioning.

The other study identified investigated cognition (primarily) and quality of life in a large cohort of people 60 years or over with new-onset epilepsy before treatment (n=257) [33]. Following neuropsychological testing (using the diagnostic program EpiTrack) over half of the cohort (58%) had cognitive impairments, with 43% of people being found to have marked impairment. Factors that were associated with cognitive impairment included cerebrovascular causes (e.g. infarction and vascular), neurological comorbidities and a higher body mass index. Subjective reporting from people with cognitive impairment revealed that forgetfulness and memory were the most frequent issues. In terms of quality of life, the mean overall score was 74 out of a possible 100 with the highest mean score for social functioning (82.7) and the lowest mean score for energy-fatigue (63.5). A better quality of life was associated with not having any neurological comorbidities and being male. Based on the findings of the study, the authors recommended that cognitive-behavioural screening be conducted in people 60 years or over with new-onset epilepsy before treatment.

One identified study investigated psychiatric and neurological conditions that may be risk factors for the development of new-onset epilepsy in people 60 years or more using a population cohort obtained from the US national Medicare beneficiaries database and prior history [34]. The authors reported an incidence rate of 2.9 per 1,000 beneficiaries with higher incidences found for older age groups (75-84 years and 85+ years). Overall, there were significantly higher comorbidity burdens in people 60 years and over, with associations found for five psychiatric diseases including substance abuse, psychosis, bipolar disorder, schizophrenia, and depression. Cerebrovascular disease and depression were found to be significantly associated with new-onset epilepsy. The incidence for psychiatric comorbidities and new-onset epilepsy ranged in between 8.8 and 29.2 per 1,000 and this was higher than for neurological conditions being 9.4 to 18.6 per 1,000. In terms of adjusted rates, the association of substance abuse/dependence was significantly lower in women and psychiatric conditions were associated with new-onset epilepsy with no history of neurological conditions.

We identified only two studies that explored the psychosocial impact relating to quality of life (QoL) in new-onset epilepsy in the elderly [35, 36]. One study from the UK utilised a community based cohort of people with new-onset epilepsy in four different age groups – 1) Men <60 years old, 2) Women <65 years old, 3) Men aged

65 or more diagnosed before age 65 and women aged 60 or more diagnosed before age 60, and 4) Men aged 65 or more diagnosed at age 65 or more and women aged 60 or more diagnosed at 60 more. Their quality of life was assessed through a postal survey using validated measures of health-related QoL [35]. People aged 65 years and over with new-onset epilepsy did not have a poorer quality of life, rather they perceived their overall quality of life as more likely to be negative particularly if they were post-retirement. The group was also reported to have more anxiety and depression compared to the younger age groups [35].

Another study investigated whether there was a difference in the psychosocial impact between people 60 years and over with new onset epilepsy (incident group) and people diagnosed with epilepsy before 65 years of age (prevalent group) [36]. This study was qualitative using in-depth face-to-face interviews. Following analysis there were eight themes of importance identified relating to the psychosocial impact of new-onset epilepsy including co-morbidities, significant life changes, emotional and physical impact (e.g. depression, anxiety, fatigue, trouble with memory and injuries due to fragile bones), information gathering, AED side effects, stigma, changes in relationships and attitude towards diagnosis. The authors concluded that new-onset epilepsy in people 60 years and over had a negative correlation with health related quality of life in comparison to people with chronic epilepsy (the prevalent group).

Discussion

We found that the most common type of epilepsy in people 60 years and over with new-onset epilepsy was focal seizures. There are key differences in clinical characteristics from the identified studies in comparison to studies in younger patients (Table 3) [37]. Firstly, seizures are generally briefer with less overt clinical features compared with younger age groups, making diagnosis more challenging. Generalized onset seizures and simple partial seizures only account for 7.1% and 5.7% in older patients [38]. Furthermore, postictal confusion can last much longer in the elderly, even up to 2 weeks compared to few minutes or few hours in younger patients. This can make epilepsy diagnosis more complicated due to misdiagnosis as delirium from other causes.

Table 3 – Comparison of new-onset epilepsy in the elderly with chronic epilepsy in the elderly and with young people

Diagnosing new-onset epilepsy in the elderly is very challenging. Elderly patients often have briefer seizures with less overt clinical features compared with younger age groups. Furthermore, long lasting postictal confusion can easily be misinterpreted as delirium or dementia [9]. Common medical issues in older adults, such as stroke and Alzheimer's disease, are the frequent causes of new-onset epilepsy [8, 39, 40, 41]. After considering specific features discussed above, selecting appropriate AEDs for older adults with new-onset epilepsy can be quite different from using AEDs for older patients *with pre-existing epilepsy*. The aim of prescribing medication is to achieve seizure freedom and reduce the consequence of injury, while minimising adverse effects.

Generally, people 60 years and over with new-onset epilepsy have a good prognosis for seizure control when using appropriate AED treatment. The percentage of patients who achieve seizure freedom can be from 84% to 92%, which is higher than in newly treated epilepsy in younger patients [22,23]. However, there is an increased risk for medical and neurological comorbidities, and mortality with new-onset epilepsy. In a retrospective study of older patients with new-onset seizures over a four-year period, 38% of them had evidence of cerebrovascular disease, such as CT visualised focal infarction or haemorrhage on small vessels ischemia [23]. Furthermore, 45% had died 1.9 years after epilepsy diagnosis [23]. This was despite treatment with AEDs being effective in maintaining seizure free in 92% of patients [23]. Copeland et al. (2011) showed that the subset of older patients with new-onset epilepsy had 52% hospitalisation rate, compared to 15% hospitalisation rate of older patients without epilepsy [5]. In patients, whose seizures cannot be controlled

with AEDs, surgery and vagus nerve stimulation (VNS) can be carried out with similar outcomes in terms of seizure control and complications in younger patients [43].

Drug selection

Almost all the available AEDs, except ethosuximide, are effective in treating older patients with new-onset epilepsy [44]. Furthermore, as discussed above, it is generally easier to achieve seizure free in older patients compared to younger age groups. However, older patients with new-onset epilepsy often have poor adherence to AED treatment, likely because of adverse effects. A study found that 42% to 63% older patients with new-onset epilepsy poorly adhere to AEDs [45]. The rate is poorer for AEDs that induce weight gain or cognitive difficulties [45].

Older patients, who have physiological changes, often have multiple comorbid conditions and take multiple medications. Thus, it is important to carefully consider drug pharmacokinetic and pharmacodynamics when treating older patients with new-onset epilepsy [46]. Hepatic and renal drug clearance is decreased in older people. These changes lead to a higher serum AED concentration than in younger adults for the same administered dose [47]. Thus, the dose for AEDs must be carefully chosen and titrated to achieve a desirable serum concentration in older adults. Moreover, AEDs that induce cytochrome P450 enzymes, such as phenytoin, carbamazepine, and phenobarbital, have most commonly been associated with osteoporosis, possibly due to the higher metabolism of vitamin D [47,48]. However, decreased bone mineral density is also seen in AEDs that are not enzyme inducers, and recent evidence suggested that newer AEDs are not necessarily safer regarding effects on bone [48]. Patients taking AEDs have an increased risk of falls and fractures, which can lead to serious consequences in older people [49, 50, 51].

Furthermore, as older patients often take multiple drugs for multiple conditions such as cardiovascular disease, diabetes, arthritis, etc., it is ideal for AEDs to have very few or no pharmacologic interactions [39]. Many of the older generation AEDs either induce the metabolism, e.g. carbamazepine phenytoin and phenobarbital, or inhibit the metabolism, e.g valproate, of many other drugs including anti-hypertensives, anti-coagulants, and anti-depressants [52]. The newer AEDs, such as lamotrigine, levetiracetam, lacosamide and gabapentin, have fewer effects on the pharmacokinetics of other medications that the older patients often take [38].

Monotherapy or polytherapy as an approach to treatment

Monotherapy is the preferred choice for older patients to minimise side effects and drug-drug interactions, with seizure freedom achieved in more than 60% of patients [54]. Drug resistant epilepsy is less common in older patients, particularly those with newly diagnosed epilepsy. However, AED polytherapy is required if resistance to monotherapy occurs. Polytherapy is associated with lower drug adherence, reduces quality of life and decline in bone density in older patients with epilepsy [55]. Therefore, before prescribing polytherapy and subjecting patients to potentially more adverse reactions and increased cost, it is important to have additional investigations to rule out other conditions that may mimic epilepsy [12].

Side effects considerations

Dose adjustment and appropriate titration are very important as the hepatic and renal capacity of older patients is often decreased. Treatment with AEDs should be started at a low dose and then gradually titrated to the target dose [56]. This will help maximise a patient's tolerability and avoid adverse side effects such as visual problems, drowsiness, dizziness and gait unsteadiness. For patients who need the introduction of AED polytherapy, if there are adverse effects, the baseline AED can be reduced to allow continued titration of the

added therapy. Moreover, dose related adverse side effects may be due to the interaction of multiple AEDs, not just solely due to the newly added AED [57].

Duration of treatment

The risk of recurrent seizure after withdrawing medication is higher in older people compared to younger people [58]. Thus, ceasing medication is less often achieved in older patients with new-onset epilepsy compared to those with chronic pre-existing epilepsy [58]. There is limited data about when to cease medication in older patients who have been seizure free for many years [44]. If there is doubt about the diagnosis of epilepsy after starting medication, ceasing medication is a reasonable option. This is a common scenario as dementia, syncope, sleep deprivation, drugs or consuming excess alcohol may have been the causes of the new-onset seizures in the older [58].

For patients who are 60 years of age or older, there are many concerns when considering resective epilepsy surgery. There is often a higher rate of comorbid medical conditions and post-surgical cognitive decline in older patients. Therefore, clinicians often worry about the lower safety profile for surgery, lower likelihood of seizure freedom after surgery and lower impact on improving quality of life. The study by Dewar et al (2016) provides promising evidence for the safety and effectiveness of surgical treatment for patients 60 years or over with pharmacoresistant epilepsy [31]. This study is the only one that identified surgical treatment for new-onset epilepsy in people 60 years or over. Although these results are promising, further studies are required to confirm the safeness and effectiveness in this special population.

The current review found conflicting evidence that people 60 years old or over with new-onset epilepsy in relation to quality of life. Two studies reported that overall quality of life was good whilst another study concluded that there was a negative correlation with health related quality of life. However, within quality of life, components including depression, anxiety and fatigue were reported to be higher in comparison to younger age groups. Unfortunately a limitation of the research studies was that the duration since the onset and diagnosis was not documented so it is difficult to determine at what point people may have been studied and could affect the results. One study has reported that older adults with new-onset epilepsy had better scores on mental and social health scales but physical function, general health and emotional health scales were lower in comparison to young or middle aged adults [59]. This study has been the only one to report better mental and social health scales. The data was obtained from the US Veterans Health Administration databases whereas other studies have used outpatient and population based samples. The current review did not include studies involving veterans, which may have been a potential limitation. Further studies are required to understand the experience of new-onset epilepsy in people 60 years and over to facilitate management that is more appropriate and ensure better long-term outcomes.

Recommendations for future research

Given the considerable difference between new-onset epilepsy in people 60 years and over and those with chronic (or established diagnosis) epilepsy, there is a need for greater differentiation of patient cohorts in research studies. As diagnosis of new-onset epilepsy in people 60 years and over is challenging, more information obtained through research studies specific to this population may assist health professionals in the management of this special population. Also, the development of standard clinical measurements specific to the older adult population (people 60 years and over) is warranted to accurately reflect this special population (e.g. HRQoL) [60].

There has been a strong increase over the last decade in research studies in the ageing population given that more people now have longer lifespans. For this very reason, it is imperative that more research efforts are invested into neurological conditions such as new-onset epilepsy, which is the third most common diagnosis in

people aged 60 and over. The greater incidence in other conditions including stroke and dementia, which are strongly, established risk factors for new-onset epilepsy in people over 60 years of age are open invitations for interdisciplinary collaborations to improve the quality of life in this age group and further reduce the incidence of these neurological conditions. The current review found one systematic review of people with AD and epilepsy, which identified one RCT, however of the three treatments there was not a significant difference in effectiveness. Identifying the prevalence and incidence of seizures and epilepsy in people with AD and understanding what the possible risk factors are for developing preventive strategies would be of great value. Also too, designing and conducting larger high quality studies of pharmacological treatments in people with Alzheimer's disease and epilepsy.

Implications for clinical practice

A recent systematic review has identified that there are currently no clinical practice guidelines for epilepsy in the older population [61]. However, we identified two publications that have reported potential guidelines for the management of epilepsy in people aged 60 years and over. Given that these publications are over a decade old and the significant increase in evidence identified by this review and others since that time, we propose that it would be beneficial as a next step to develop clinical practice guidelines for people aged 60 years or over with new-onset epilepsy to improve current management.

The hospitalisation rate of new-onset epilepsy in people 60 years and over is three times higher in comparison to people with chronic established epilepsy [5]. Another study has also highlighted the importance of people 60 years and over who present to hospital with seizures [62]. The authors concluded that based on a national audit of seizure management from hospitals in the UK, people 60 years and over who are admitted should be referred to a specialist epilepsy clinic/service upon their discharge.

A well-known concept of significant importance in current clinical practice is patient-centred care. Patient-centred care is informed by the patient's views of their own experience. Early evidence suggests that problems and needs experienced by people 60 years and over with new-onset epilepsy can be grouped in six categories – Information, Physical and Emotional Symptoms, Memory and concentration, Medications, Commitments and Relationships [63]. Outcomes have also been studied and reported with themes including Maintaining Normalcy, We Want to be involved, Well-Equipped, Seizure Freedom, Fitting Epilepsy in with Other conditions, Incongruence with provider goals. These findings provide evidence for health professionals to develop a framework or future interventions, and to use in counselling and educating people 60 years and over with new-onset epilepsy [64].

Conclusion

New-onset epilepsy in people aged 60 and over is a common condition, which is more often difficult to diagnose and presents different therapeutic challenges compared to chronic established epilepsies in older adults or epilepsies in younger patients. The current review was able to identify a number of published studies on the causes, prognosis, treatment, and psychosocial impact of new-onset epilepsy in this age group. The most common identifiable causes of new-onset epilepsy in this population are stroke and Alzheimer's disease. The findings concluded that is important to choose suitable AEDs, titrate carefully and use monotherapy whenever possible to limit adverse side effects and drug interactions. As people who are 60 years and over undergo significant emotional and life changes it is important to consider these as a part of their treatment and long-term management. Further higher quality clinical trials are needed to determine more effective treatments that do not have adverse side effects. Although the prognosis for most people 60 years and over with new-onset epilepsy is good, it is also important to note the high mortality that can occur as a result of

other neurological comorbidities, physiological changes with age and psychological issues. More investment towards research studies that focus on developing clinical measurements that are specific to this population, clearer reporting of duration since diagnosis, surgical intervention for uncontrolled epilepsy, strategies aimed towards reducing and/or preventing the incidence of new-onset epilepsy in people with Alzheimer's disease and stroke, and management incorporating patient-centred care and outcomes are needed. Unless preventive therapy can be developed, it is expected that the incidence of new-onset epilepsy in people 60 years and over will continue to increase.

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