

Literature Review

## How Can Acupuncture Be Used in Treating Dementia?

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**Academic Editor:** James D. Adams

**Special Issue:** Complementary and Alternative Medicine in Nervous System Conditions

*OBM Integrative and Complementary Medicine*  
2018, volume 3, issue 2  
doi:10.21926/obm.icm.1802005

**Received:** March 2, 2018

**Accepted:** April 11, 2018

**Published:** April 23, 2018

### Abstract:

**Background:** Dementia erodes the quality of life of patients and their caregivers, and the growing dementia population threatens public finance in the health and social services. In addition to formal medical treatments, complementary and alternative medicine is applicable to dementia, in which acupuncture has become an option for prevention, remedy, and rehabilitation. Acupuncture is a traditional Chinese medical method that uses needle penetration at acupoints (specific points throughout the body which will be stimulated for therapeutic achievements), resulting in alleviating dementia symptoms; for example, enhancements in cognition, memory, language, behaviour, emotion, and self-care.

**Methods:** This narrative review analyses 44 clinical human-based studies conducted 1998-2017, pertaining to 3078 participants who were 45-100 years old in Austria, China, Hong Kong, Japan, and the USA.

**Results:** This review offers an overview of various methods of acupuncture (using acupuncture alone or combined with other therapies), and how they can be conducive to people inflicted by dementia.

**Conclusions:** This study also reveals future research directions to develop acupuncture, which offers a novel approach to health care practitioners and patients.



## **Keywords**

Alzheimer's disease; traditional Chinese medicine; complementary and alternative therapy; dementia; narrative review; neuro-degenerative syndrome; rehabilitation

## **1. Introduction**

Statistical data warn that 7.7 million new cases each year worldwide have been added on top of the existing 47.5 million people with dementia [1]. Dementia is a neuro-degenerative syndrome [2] caused by a reduction in the number of neurons, resulting in a deterioration of neuronal structure and functions, which incurs a progressive or chronic decline in cognition, thinking, memory, comprehension, language, learning, judgement, behaviour, emotion, and self-care [3]. These impairments demand about 1% of the global gross domestic product [4] to serve patients and their families, and deplete the workforce in cases where young-onset dementia begins before 65 years old [5].

The aetiological mechanism of dementia has not yet been well-identified [6], but this disease stems from a variety of heterogeneous factors [7], yielding various types such as senile dementia (Alzheimer's disease) [8], vascular dementia [9], Lewy bodies dementia, frontotemporal dementia, and primary progressive aphasia [10]. Additionally, in 12-20% of patients [11, 12], the disease is induced by reversible causes [13]; for example, depression induced cognitive impairment, surgical brain lesions, tumours and chronic subdural hematomas, structural brain abnormalities, metabolic disorders, alcohol and medication related dementia, toxicants, infection, and nutritional deficiencies [14], which are all likely treatable.

Apart from formal medical treatments for dementia, including medication, behavioural-oriented therapies, and psychosocial interventions [15-17], complementary and alternative medicine has been adopted with positive outcomes [18], for instance, aerobic exercise [19], art therapy [20], creative therapy [21], dancing therapy [22], music therapy [23], gardening [24], and Ginkgo biloba [25], together with traditional Chinese methods [26].

Many ancient Chinese medicinal records [27], such as the Emperor's Inner Canon [28] (also known as Huangdi Neijing or the Inner Canon of Huangdi), documented the effectiveness of acupuncture on syndromes or symptoms that are similar to dementia. Acupuncture is a Chinese medical method that has been practised for over 3,000 years. Its objective is to restore the flow of qi (energy) within the body [29] through the stimulation of nerve endings, which consequently enhances brain function [30], attaining healthy, balanced life energy [31]. It normally uses 5-15 needles penetrating at specific points (namely, acupoints) from 365 acupoints located along 14 meridians [32] throughout the body.

Acupuncture has become an option for treating Parkinson's disease [33], Alzheimer's disease [34, 35] and dementia [36, 37], as supported by Chinese projects since the 1980s [38]. In particular, its effects on vascular dementia have shown improvements in memory, cerebral ischemia, hippocampus function, and synaptic plasticity, in the regulation of vasoactive substances and blood flow in the brain, in the prevention of excessive free radicals, the facilitation of angiogenesis, the inhibition of neuronal apoptosis, and in the modulation of neurotransmitter production, as

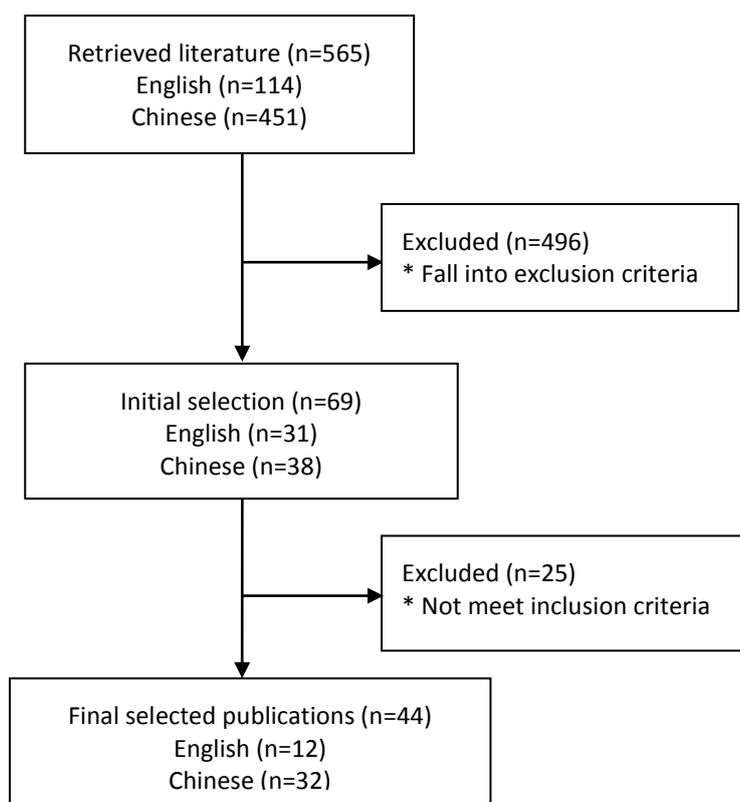
well as increases in glucose metabolism [39-44], and the amelioration of cognitive impairment [45]: albeit Lee and colleagues [46] are hesitant regarding these outcomes.

Diverse acupuncture methods have been utilised for dementia, such as body acupuncture, scalp acupuncture, ophthalmic acupuncture, tongue acupuncture, and acupoint injection [47-50]. Moreover, acupuncture may combine with other approaches [51-53]; for example, Chinese herbs [54], pharmaceutical drugs [55], and moxibustion [56]. Benefiting from modern technology, it has also developed further into different modes, including electro-acupuncture, and laser acupuncture.

This narrative review analyses how acupuncture can alleviate dementia symptoms, through either acupuncture alone or through combined therapies. The findings of the reviewed clinical research potentially supply alternatives to medical practitioners and patients for preventive, curative, and rehabilitative purposes.

## 2. Research Methods

This review adopted 27 major digital databases in ProQuest; for instance, Biological Sciences, British Nursing Index, MEDLINE, ProQuest Medical Library, PsycARTICLES, and PsycINFO. The keywords “acupuncture”, “dementia” and “Alzheimer’s disease” were input; 114 studies were listed. Additionally, two significant Chinese databases – China National Knowledge Infrastructure (CNKI) and Taiwan Electronic Periodical Services (TEPS) – were employed, in which the keywords included “針灸” and “失智症 OR 癡呆症 OR 腦退化症 OR 認知障礙症 OR 阿茲海默症 OR 阿爾茨海默氏症”, resulting in 451 potential projects.



**Figure 1** Selection process

The retrieved clinical human-based research which was published in peer-reviewed scholarly journals prior to 2018 was selected. Duplicated works, non-resultant trials, literature reviews, book reviews, dissertations, letters to the editor, and commentaries were excluded. According to the eligibility criteria, 44 projects (n=12 in English, n=32 in Chinese) were reviewed (Figure 1), which included 3078 participants who were 45-100 years old in Austria (n=1), China (n=40), Hong Kong (n=1), Japan (n=1) and the USA (n=1), and were carried out from 1998 to 2017.

### **3. Results and Discussion**

This narrative review (refer to Table 1) delves into the effects of acupuncture on dementia from the perspectives of being used singly, or in combination with other therapies, impacting neurological effects and reducing dementia-induced mental problems. Also, comparison studies analyse the effectiveness of different combined approaches. The research outcomes unveil decreases in dementia symptoms following both acupuncture used alone and combined methods; however, the latter yields a higher effectiveness rate.

#### **3.1 Acupuncture Used Alone**

This narrative review investigates the effects of using acupuncture alone on neurological, cognitive, and mental improvements [57, 58]. It also exhibits comparison studies which have compared the effectiveness of acupuncture and medication, as well as different acupuncture techniques.

**Neurological changes.** Acupuncture has remarkable benefits for cognition in dementia rehabilitation [59], likely due to the following discoveries. When stimulating points at Taichong (LR3) and Hegu (LI4), it increases connectivity in most of the hippocampus-related regions in patients affected by Alzheimer's disease, particularly the connection between the right middle front lobe and the left hippocampus [60]. This path activates the cognitive-associated regions [61], especially those that contribute to early dementia [62].

Randomly assigned to two groups [63], ten participants with vascular dementia and stroke experience each underwent 20-minute sessions but at different acupoints for these two groups. Assessments were carried out using positron emission tomography (PET), which indicated cerebral metabolism in the lentiform nucleus of the affected hemisphere, and the temporal lobe of the non-affected hemisphere. One case study reported that a 77-year-old woman with cerebral-vascular dementia intensified both cerebral oxygen saturation and cerebral blood flow velocity after seven 10-minute acupuncture sessions (by needle and laser), improving cognitive function, motor speech function, short memory, sleeping, and headaches [64], along with quality of life [65].

**Lowering cognitive symptoms.** Shi [66] evaluated the effects of acupuncture among 36 participants with vascular dementia who joined an intervention, reporting enhancements in cognition, memory, and language 14 days after treatment, and in visual and spatial skills 28 days after treatment. However, there was a lack of intervention details. Another research programme with 54 patients received 30 13-minute sessions for scalp acupuncture, resulting in improved cognitive function, including gains in orientation, calculation, and behaviour [67], which was supported by a Japanese project [68] and a randomised controlled trial [69] showing significant improvements in cognitive ability and daily life activities.

**Weakening dementia-related mental problems.** Apart from neuro-refinement, acupuncture can also treat dementia-led mental illnesses through the amelioration of outside symptoms: such as sleep problems, which worsen dementia symptoms [70]. In a within-subjects designed project, 19 participants were observed in the control stage for six weeks, after which they took part in 12 30-minute sessions for another six weeks [71]. Despite the absence of significant indicators of sleep efficiency on the pre- and pro-tests, improvements in resting and sleeping times were apparent after treatment.

Depression is common in the dementia population [72], which in turn increases risks for dementia as well [73]. Lombardo and colleagues [74] investigated 11 patients who were given three 30-minute sessions in the first week and 2-3 sessions per week in weeks 7-10. Although they reported slight amelioration in depression and anxiety, they experienced significant enhancements in energy.

**Comparison studies.** Zhu and colleagues [75] randomly allocated 30 patients to receive 30-minute daily acupuncture treatments for 8 weeks, and another 30 patients to take 30mg of nimodipine, thrice a day for 8 weeks. Improved scores were reported in the Mini-Mental State Examination and Montreal Cognitive Assessment, and lower levels of high sensitivity C-reactive protein (hs-CRP) and interleukin-6 (IL-6) levels were apparent in both groups. Moreover, better indicators in the Syndrome Differentiation Scale of Vascular Dementia and in the above tests were exhibited in the acupuncture group than in the medication group, implying better enhancements in cognition. This was further supported by Liu and team [76], Jia [77], Tan and colleagues [78], and Zheng and Zhang [79]. Another similar study compared acupuncture and piracetam, showing more positive signals on P300 (an endogenous potential) in the acupuncture group, implying better improvements in their memory, cognition, and emotions [80]. Zhu [81], as a supplement to his research, reported that 95% of patients in the acupuncture group revealed improvements in cognition, compared to 75% in the piracetam group.

Aside from the basic one-needle-one-acupoint technique, point-through-point acupuncture has also been utilised. This special technique reaches more than one acupoint by means of a single needle. Thirty patients were randomly distributed to the basic technique group and another 30 to the point-through-point group. They underwent 30-minute daily sessions over a period of 30 days. Results showed that 83.3% of patients in the latter group yielded improvements in their dementia symptoms, compared to 60% in the former [82].

### **3.2 Combined Methods**

In addition to the confident results from acupuncture treatments used alone to treat dementia, researchers have examined combined interventions that present even greater effectiveness [83].

**With neuro-developmental therapy.** One project assigned 39 patients to a Bobath therapy group, and another 39 to an experimental group that combined acupuncture and the Bobath technique [84]. Bobath therapy is a multidisciplinary neuro-developmental approach for neurological rehabilitation to improve motor control, body alignment, and movement coordination. 91.4% of patients in the experimental group indicated improvements in neurological impairment, cognitive function, and daily activities, compared to 85.3% in the Bobath therapy group.

**With medications.** Studies comparing the combination of acupuncture and drugs reveal positive signs as well. One study spelled out improvements in cognition, memory, and language, following 14 days of treatment using acupuncture and medication, and in visual spatial skills after 28 days of treatment [85]. This was supported by other research [86]. However, no information about the medication was provided in these projects.

Liu and team [87] randomly assigned 168 patients to two groups equally for a 56-day examination period. The control group took 5mg of donepezil hydrochloride once a day; the treatment group took the same dose along with acupuncture. The results presented more noticeable improvements in cognitive functions in the latter than in the former. In another project, both the experiment and control groups were offered identical therapy: acupuncture and medication (antiplatelet agents, antihypertensive, diuretics and nimodipine) [88], and the experimental group was given additional acupuncture treatments at different acupoints. They improved in cognitive function, memory, and self-care, but the effectiveness rates differed: 80% for the former, and 46.7% for the latter. Therapy combining acupuncture and piracetam tablets produced similar outcomes [89, 90].

Three equal groups were randomly distributed [91]: Group 1 was given 30 minutes of acupuncture and moxibustion; Group 2 was given 20mg huperzine A tablets, thrice per day for 30 days; and Group 3 was assigned acupuncture, moxibustion, and tablets. Improvements were reported related to cognitive functions: 83.3% in Group 1, 66.7% in Group 2, and 93.3% in Group 3, reflecting the effectiveness of combined Chinese and Western methods.

Comparison has also been applied to Chinese medicine with encouraging results in recent studies; for instance, Guo [92], He and colleagues [93], Huang [94], Li and members [95], Ni [96], Niu [97], and Yang and team [98]. One project with 68 participants randomly allocated between an acupuncture group and an acupuncture with Six Flavour Rehmanni (Chinese medicine) group [99]. Improvements were apparent in 88.2% of the patients in the combined group, but only 67.6% in the single treatment group. Nevertheless, participants underwent differing treatment periods: 30 days (n=24), 40 days (n=22), 50 days (n=12), and 60 days (n=10). Further analyses became difficult owing to insufficient details on research design and results.

Looking into the effects of different combinations, 60 patients were randomly, equally assigned to an acupuncture with Chinese medicine group, an acupuncture with Western drugs group (folic acid 10mg, vitamin B6 30mg, huperzone A tablet 0.1mg, twice a day), and a non-treatment group [100]. According to the three measurements at pre-treatment, and at the 3<sup>rd</sup> and 6<sup>th</sup> months, the acupuncture with Chinese medicine group exhibited better outcomes than the acupuncture with Western drugs, and no changes were presented in the non-treatment group.

Moreover, Wu and Guo [101] recruited 56 patients who undertook a daily programme, including acupuncture, Chinese medicine, and drugs (donepezil and nicergoline). The findings showed 83% success rate and low side effect rate (10%). They also indicated significant improvements in self care and quality of life. Other research substantiated these outcomes [101-103].

**Table 1** Analysis of the 44 reviewed studies

Source	Research objective	Sample size	Intervention	Results	Research location
Guo [92]	To compare the effects of acupuncture and Chinese medicine on vascular dementia.	98 patients (n=56 males, n=42 females), aged 51-77.	Randomly allocated to the acupuncture with Chinese medicine (n=49; n=29 males, n=20 females; aged 52-76), and Chinese medicine (n=49; n=27 males, n=22 females; aged 51-77) groups. No details of treatment.	Improvements in hemodynamic index in acupuncture with Chinese medicine group.	China.
Huang [94]	To compare the effects of acupuncture with medicine and drug alone on Alzheimer's disease.	170 patients, aged 60-85. Unspecified sex ratio.	Randomly distributed to acupuncture with medicine (n=100; aged 60-85), and drug (selegiline, piracetam, donepezil, and Chinese medicine) (n=70; aged 60-83) groups. Acupuncture: 20-30 minutes session, total 20-30 sessions.	Effect rate: 98% in acupuncture with medicine group, 89% in drug group. Better scores in Mini-Mental State Examination (MMSE) and Activity Daily Living (ADL) in acupuncture and Chinese medicine group.	China.
Jia, Zhang [77]	To compare the effects of acupuncture and drug on Alzheimer's disease.	87 patients (n=29 males, n=58 females). Unspecified age range.	Distributed to the acupuncture (n=43; n=13 males, n=30 females), and drug (n=44; n=16 males, n=28 females) groups. Acupuncture: 30-minute session, 3 times a week, total 36 sessions. Drug: donepezil 5mg daily.	Better improvements in acupuncture group than in drug group. Side effect rate: 12% in acupuncture group, 16% in drug group.	China.

Source	Research objective	Sample size	Intervention	Results	Research location
Li, Feng [95]	To compare the effects of Chinese and Western medicine and drug alone on dementia.	90 patients (n=41 males, n=49 females), aged 60-81.	Randomly assigned to the Chinese and Western medicine (n=45; n=21 males, n=24 females; aged 61-80), and drug (n=45; n=20 males, n=25 females; aged 60-81) groups. No details of acupuncture intervention.	Effect rate: 98% in Chinese and Western medicine group, 87% in drug group. Side effect rate: 2% in Chinese and Western medicine group, 4% in drug group.	China.
Li and Li [57]	To compare the effects of acupuncture at neck and bodily acupuncture on vascular dementia.	60 patients (n=38 males, n=22 females), aged 55-76.	Randomly distributed to the acupuncture at neck (n=30; n=20 males, n=10 females; aged 55-75), and acupuncture (n=30; n=18 males, n=12 females; aged 55-76) groups. Acupuncture: 40-minute session, total 56 sessions.	Effect rate: 80% in acupuncture at neck group, 57% in acupuncture group.	China.
Liu, Zhao [102]	To compare the effects of Chinese and Western medicine on vascular dementia.	120 patients (n=71 males, n=49 females), aged 60-89.	Randomly allocated to the Western medicine (n=40; n=24 males, n=16 females), Chinese and Western medicine (n=40; n=22 males, n=18 females) and Chinese medicine (n=40; n=25 males, n=15 females) groups. No details of acupuncture treatment.	Effect rate: 78% in Western medicine group, 98% in Chinese and Western medicine group, 83% in Chinese medicine group.	China.
Nakamura, Huodo [68]	To evaluate the effects of acupuncture on vascular dementia.	56 patients (n=17 males, n=39 females), aged 60-100.	12 sessions. Unspecified session duration.	Significant improvements in physical, behavioural, and psychological activities.	Japan.
Ni [96]	To compare the effects of acupuncture with	65 patients (n=36 males, n=29 females);	Allocated to the acupuncture with Chinese medicine (n=33; n=18 males, n=15 females; aged 65-79), and drug (n=32; n=18 males,	Effect rate: 82% in acupuncture with Chinese medicine group, 59% in drug group.	China.

Source	Research objective	Sample size	Intervention	Results	Research location
	Chinese medicine and drug on Alzheimer's disease.	aged 65-80.	n=14 females; aged 66-80) groups. Acupuncture: 30-40 minutes daily sessions, total 60 sessions. Drug: donepezil hydrochloride tablets 5mg daily.		
Niu [97]	To compare the effects of acupuncture with Chinese medicine and drug on vascular dementia.	100 patients (n=56 males, n=44 females), aged 64-77.	Randomly assigned to the acupuncture with Chinese medicine (n=50), and drug (n=50) groups. No details of acupuncture treatment. Drug: donepezil 5mg daily.	Effect rate: 96% in acupuncture with Chinese medicine group, 78% in drug group. Significant improvements in memory, attention, calculation, recollection, and language ability in acupuncture with Chinese medicine group than in drug group.	China.
Tan, Ren [78]	To compare the effects of acupuncture and drug on vascular dementia.	60 patients (n=36 males, n=24 females). Unspecified age range.	Randomly allocated to the acupuncture (n=30; n=17 males, n=13 females), and drug (n=30; n=19 males, n=11 females) groups. Acupuncture: 30-minute daily session, total 30 sessions. Drug: nicergoline 20mg, 3 times a day, 30 days.	Effect rate: 93% in acupuncture group, 73% in drug group.	China.

Source	Research objective	Sample size	Intervention	Results	Research location
Wu and Guo [101]	To compare the effect of combined treatment (acupuncture, Chinese medicine, drug) and drug on dementia.	56 patients (n=26 males, n=30 females). Unspecified age range.	Randomly distributed to the combined treatment (acupuncture, Chinese medicine, drug) (n=30; n=16 males, n=14 females), and drug (n=26; n=10 males, n=16 females) groups. Acupuncture: 1-minute session, twice a day, unspecified total sessions. Drug: donepezil 5mg daily; nicergoline 30mg, 3 times a day.	Effect rate: 83% in combined treatment group, 54% in drug group. Side effect rate: 10% in combined treatment group, 54% in drug group. Better improvements in self care and quality of life in combined treatment group than drug group.	China.
Yang, Yin [98]	To compare the effects of acupuncture with Chinese medicine and drug on vascular dementia.	106 patients (n=55 males, n=51 females), aged 54-73.	Randomly allocated to acupuncture with Chinese medicine (n=53; n=27 males, n=26 females; aged 54-73), and drug (n=53; n=28 males, n=25 females; aged 54-71) groups. Acupuncture: unspecified session duration, total 30 sessions.	Effect rate: 93% in acupuncture with Chinese medicine group, 74% in drug group.	China.
Zhu [83]	To compare the effects of warming acupuncture and standard care on senile dementia.	92 patients (n=60 males, n=32 females), aged 58-82.	Randomly assigned to the warming acupuncture (n=46; n=28 males, n=18 females; aged 58-82), and standard care (n=46; n=32 males, n=14 females; aged 59-80) groups. No details of acupuncture treatment.	Effect rate: 91% in warming acupuncture group, 65% in standard care group.	China.
Cui, Li [58]	To compare the effects of various kinds of acupuncture on dementia.	226 patients (n=119 males, n=107 females), aged 58-79.	Distributed to the acupuncture on head (n=26), bodily acupuncture (n=34), hydro-acupuncture (n=29), acupuncture with Chinese medicine (n=61), and multiple therapy (n=76) groups. Acupuncture: 30-minute session, total 75 sessions.	Effect rate: 12% in acupuncture on head group, 15% in bodily acupuncture group, 27% in acupuncture with Chinese acupuncture, 34% in multiple therapy group.	China.

Source	Research objective	Sample size	Intervention	Results	Research location
Feng [103]	To compare the effects of combined treatment and drug on vascular dementia.	50 patients. Unspecified sex ratio and age range.	Randomly distributed to the combined treatment (n=25), and drug (n=25) groups. Combined treatment: acupuncture, Chinese medicine, and nicergoline. Acupuncture: 30-minute daily sessions, total 14 sessions. Drug: nicergoline 10mg.	Better improvements in the combined treatment group.	China.
He, Li [93]	To compare the effects of electro-acupuncture and manual acupuncture on vascular dementia.	60 patients (n=34 males, n=26 females), aged 49-76.	Randomly assigned to the electro-acupuncture with Chinese medicine (n=30; n=18 males, n=12 females; aged 51-71), and acupuncture with Chinese medicine and rehabilitation programme (n=30; n=16 males, n=14 females; aged 49-76) groups. Acupuncture: 1-hour session, total 24 sessions.	Better results in electro-acupuncture with Chinese medicine group.	China.
Liang [89]	To compare the effects of warming acupuncture and drug on senile dementia.	74 patients (n=52 males, n=22 females). Unspecified age range.	Randomly allocated to the warming acupuncture (n=37; n=27 males, n=10 females), and drug (n=; n=25 males, n=12 females) 37groups. Acupuncture: unspecified session duration, total 90 sessions. Drug: piracetam 0.8g, 3 times per day, 3 months.	Effect rate: 95% in warming acupuncture group, 70% in drug group.	China.

Source	Research objective	Sample size	Intervention	Results	Research location
Liu, Wang [87]	To evaluate the protective effect of acupuncture with donepezil hydrochloride for treating vascular dementia after stroke.	168 patients (n=106 male, n=62 female), aged 45-75.	Randomly assigned to 2 groups: taking donepezil hydrochloride (n=84; n=52 male, n=32 female), and taking donepezil hydrochloride with acupuncture (n=84; n=54 male, n=30 female). Donepezil hydrochloride: 5mg/day, once a day, 7 days a course, 8 courses.	Noticeable improvements in cognitive functions	China.
Shao [86]	To compare the effects of acupuncture with drug and drug only on dementia.	86 patients (n=44 males, n=42 females); unspecified age range.	Randomly distributed to the acupuncture and drug (n=43; n=24 males, n=19 females), and drug only (n=43; n=20 males, n=23 females) groups. Acupuncture: 30-minute daily session, unspecified total sessions.	Effect rate: 81% in acupuncture and drug group, 56% in drug only group.	China.
Shi [66]	To assess the effects of acupuncture on vascular dementia.	36 patients (n=24 male, n=12 female). Unspecified age range.	Unspecified session duration and total sessions.	Improvements in cognition, memory, and language 14 days after treatment. Improvements in visual and spatial skills 28 days after treatment.	China.

Source	Research objective	Sample size	Intervention	Results	Research location
Zheng and Zhang [79]	To compare the effects of acupuncture with Chinese medicine and drug on C-reactive protein among the elderly with dementia.	80 patients (n=47 males, n=33 females). Unspecified age range.	Randomly distributed to the acupuncture with Chinese medicine (n=40; n=24 males, n=16 females), and drug (n=40; n=23 males, n=17 females) groups. Acupuncture: 30-minute daily session, total 28 sessions. Drug: alprazolam 0.4mg, twice a day; paroxetine 40-60mg daily.	A greater decrease in C-reactive protein in acupuncture with Chinese medicine group than in drug group. Better improvements in self-care, self-esteem, language, and emotional control in acupuncture with Chinese medicine group.	China.
Guan [99]	To compare the effects of acupuncture and acupuncture with Chinese medicine on senile dementia.	68 patients (n=36 males, n=32 females), aged 60-85.	Randomly assigned to the acupuncture (n=34; n=17 male, n=17 female) and acupuncture with Chinese medicine (Six Flavour Rehmanni) (n=34; n=19 male, n=15 female) groups. 10 sessions a course, 3 course a cycle. Number of treatment courses: 3 (n=24), 4 (n=22), 5 (n=12), 6 (n=10).	88% (n=30) and 68% (n=24) showed significant improvements in acupuncture with Chinese medicine and acupuncture groups respectively.	China.
Li, Wang [82]	To compare the effects of scalp acupuncture point-through-point and general acupuncture on vascular dementia.	60 patients (n=35 male, n=25 female), aged 50-77.	Randomly assigned to scalp acupuncture point-through-point (n=30; n=16 male, n=14 female), and general acupuncture (n=30; n=19 male, n=11 female) groups. Both groups: 60-minute per session, once a day, 30 days a course.	83% in the scalp acupuncture point-through-point group showed improvements, while 60% in the general acupuncture group.	China.

Source	Research objective	Sample size	Intervention	Results	Research location
Re and Chen [67]	To look into the effects of scalp acupuncture on dementia.	54 patients (n=34 male, n=20 female), aged 66-84.	13-minute daily session, 10 times a course, 3 courses.	Improved cognitive functions, including orientation, calculation, and behaviour.	China.
Shi, Li [69]	To examine the effects of acupuncture on vascular dementia.	63 patients with routine care (n=29 male, n=34 female). Unspecified age range.	Randomised controlled trial. 3 groups: randomised acupuncture (n=22; n=12 male, n=10 female), non-randomised acupuncture (n=19; n=6 male, n=13 female), and control (n=22; n=11 male, n=11 female) groups. 1 30-minute session every alternate day, 6 weeks, maximum 21 sessions. Measurements: baseline, after 6-week treatment, and after 4-week follow-up.	Significant improvements in cognitive status and activities of daily life. Limited effects on health-related quality of life.	China.
Zhu, Cai [75]	To compare the effects of acupuncture and medication on dementia.	60 patients (n=33 males, n=27 females). Unspecified age range.	Randomly assigned to the acupuncture (n=30; n=17 male, n=13 female) and medication (n=30; n=16 male, n=14 female) groups. Acupuncture: 30-minute once a day, 6 times per week, 4 weeks a course, 2 courses. Medication: nimodipine 30mg, 3 times a day, 8 weeks.	The acupuncture group shows better improvements in cognition measured by Mini-Mental State Examination and Montreal Cognitive Assessment, high sensitivity C-reactive protein (hs-CRP) and interleukin-6 (IL-6).	China.

Source	Research objective	Sample size	Intervention	Results	Research location
Liang, Wang [62]	To examine the effects of acupuncture on vascular dementia.	28 participants (n=14 patients with Alzheimer' disease, (n=14 normal elders). Unspecified sex ratio and age range.	3-minute session, unspecified total sessions.	Effective on early dementia.	China.
Pan, Ge [80]	To compare the effects of acupuncture and medication on vascular dementia by measuring P300.	116 patients, aged 48-80. Unspecified sex ratio.	Randomly assigned to the acupuncture (n=58) and medication (n=58) groups. Intervention group: 30-minute daily session, 15 sessions a course, 3 courses. Control group: piracetam 0.8g, 3 times a day, 6 weeks a course.	Positive signs on P300, implying potential improvements in memory, cognition, and emotion.	China.
Shi [85]	To investigate the effects of acupuncture and medication on vascular dementia.	21 patients (n=14 males, n=7 females). Unspecified age range.	No details of treatment.	Improvements in cognition, memory, and language after 14-day treatment. Improvements in visual spatial skills after 28-day treatment.	China.

Source	Research objective	Sample size	Intervention	Results	Research location
Wang, Liang [60]	To examine the effects of acupuncture on hippocampal connectivity in patients with Alzheimer's disease using functional magnetic resonance imaging (fMRI).	28 participants (n=14 patients with Alzheimer's disease, n=14 healthy elders). Unspecified sex ratio and age range.	3 minutes acupuncture. Unspecified total sessions.	Increased connectivity in most of the hippocampus related regions in Alzheimer patients (particularly the connectivity between the right middle front lobe and the left hippocampus) after acupuncture, but no evident connectivity in the right or left hippocampus. Tai Chong (LR3) and He Gu (LI4) affect the connectivity. The bilateral thalamus showed significantly higher connectivity with the left hippocampus, while the medial prefrontal cortex showed significantly lower connectivity with the left hippocampus. In addition, the left thalamus, middle frontal lobe, and insula showed significantly higher connectivity with the right hippocampus following acupuncture in the control group.	China.
Zhu [81]	To compare the effects of acupuncture and medication on dementia.	80 patients (n=35 male, n=45 female), aged 55-91.	Randomly assigned to the acupuncture (n=40; n=18 male, n=22 female) and medication (piracetam) (n=40; n=17 male, n=23 female) groups. Acupuncture: once a day, 10 days a course, 3 months; unspecified session duration. Medication: piracetam 1.4g, 3 times a day, 10	95% of the acupuncture group showed improvements in cognition, comparing to 75% in the medication group.	China.

Source	Research objective	Sample size	Intervention	Results	Research location
			days a course, 3 months.		
Kwok, Leung [71]	To examine the effects of acupuncture on sleep problems of patients with dementia.	19 patients, aged 55-90. Unspecified sex ratio.	12 weeks: first 6 weeks for control stage, and the next 6 weeks for treatment. 12 30-minute sessions in 6 weeks.	Improvements in resting and sleeping time. No significant indicators of sleep efficiency and cognition.	Hong Kong.
Wang, Nie [61]	To inquire into the effects on acupuncture on mild cognitive impairment and Alzheimer disease.	36 patients (n=13 male, n=23 female; n=8 mild cognitive impairment, n=14 Alzheimer disease, n=14 healthy people). Unspecified age range.	3-minute session; unspecified total sessions.	Positively activate cognitive-related regions.	China.

Source	Research objective	Sample size	Intervention	Results	Research location
Liu and Wang [100]	To compare the effects of acupuncture with Chinese medicine and Western medicine on vascular dementia.	60 patients (n=44 males, n=16 females), aged 45 years old.	Randomly assigned to the acupuncture with Chinese medicine (n=20; n=14 male, n=6 female), Western medicine (n=20; n=16 male, n=4 female), and control (non-treatment) (n=20; n=14 male, n=6 female) groups. Acupuncture with Chinese medicine: medicine 2 times a day, and acupuncture once a day. Unspecified session duration and total sessions of acupuncture. Western medicine: folic acid 10mg, vitamin B6 30mg, huperzine A tablet 0.1mg, twice a day. Measurements: pre-treatment, 3 months, and 6 months.	The acupuncture with Chinese medicine group showed more significant improvements than that in the Western medicine group. No improved signs showed in the control group.	China.
Ye, Ma [84]	To evaluate the effects of acupuncture (warming needle) on vascular dementia.	78 patients (n=56 males, n=22 females), aged 49-76.	Randomly assigned to 2 groups: intervention (routine treatment + acupuncture; n=39, n=27 male, n=12 female) and control (routine treatment; n=39, n=29 male, n=10 female) groups. Acupuncture: once a day, 5 days a course, 8 courses; unspecified session duration. Routine treatment: Bobath therapy. Measurements: baseline, 8-week, 3-month.	Improvements in neurological impairment, cognitive function, and daily activities; 91% in the intervention group, and 85% in the Bobath group.	China.

Source	Research objective	Sample size	Intervention	Results	Research location
Liu, Zhang [76]	To assess the effects of scalp acupuncture on vascular dementia.	92 patients. Unspecified sex ratio and age range.	Randomly assigned to the acupuncture (n=47) and medication (n=45) groups. Scalp acupuncture: 30-minute daily session, 6 times a course, 5 courses. Medication: nimodipine tablets, 40mg, 3 times a day, 30 days.	Improvements in cognitive function, and daily activities in the acupuncture group.	China.
Huang, Chen [63]	To investigate the effects of acupuncture on cerebral metabolism for rehabilitation of vascular dementia.	10 patients with vascular dementia and stroke experience, aged 62-75 years old (n=5 male, n=5 female).	Randomly assigned to 2 groups with 20-minute acupuncture: Group A with acupuncture on Jianyu (LI15), Waiguan (SJ5), Hegu (LI4), Xuehai (SP10), Zusanli (ST36), Sanyinjiao (SP6) and Taichong (LR3), Group B with acupuncture on Jianyu (LI15), Waiguan (SJ5), Hegu (LI4), Xuehai (SP10), Zusanli (ST36), Sanyinjiao (SP6), Taichong (LR3), Baihui (DU20), Shuigou (DU26), and Shenmen (HT7). Unspecified total sessions.	In group A (routinely treated patients) glucose metabolism was higher after treatment than before in the lentiform nucleus of the affected hemisphere and the temporal lobe of the non-affected hemisphere ( $p < .05$ ). In group B (VaD-specific needling), metabolism increased bilaterally in frontal lobes and thalami, as well as in the temporal lobe and the lentiform nucleus of the non-affected hemisphere ( $p < .05$ ).	China.

Source	Research objective	Sample size	Intervention	Results	Research location
Yu, Zhang [88]	To examine the effects of acupuncture with medicine on vascular dementia.	60 patients (n=45 male, n=15 female). Unspecified age range.	Randomly assigned to treatment (horizontal insertion acupuncture, acupuncture + routine medication) (n=30; n=22 male, n=8 female) and control (acupuncture and routine medication) (n=30; n=23 male, n=7 female) groups. 30-minute daily sessions for 6 weeks. Routine medication: antiplatelet agents (aspirin or ticlopidine), antihypertensive, diuretics and nimodipine.	Improved cognitive function, memory, and self care; 80% in the treatment group and 47% in the control group.	China.
Jin and Jin [90]	To compare the results of acupuncture and acupuncture with medicine for vascular dementia treatment.	56 patients (n=31 male, n=25 female), aged 58-72.	Randomly assigned to the acupuncture (n=26) and combined treatment (n=30) groups. Acupuncture: 30-minute daily session, 2 months; unspecified total sessions. Medication: piracetam tablet, 3 tablets per dose, 3 doses a day, 2 months.	Both groups showed improvements, and the combined group showed more significant enhancements; 90% in the combined group and 84.1% in the acupuncture group.	China.
Schwarz, Litscher [64]	To look into the effects of acupuncture on vascular dementia by increasing both cerebral oxygen saturation and cerebral blood flow velocity.	One (n=1) 77-year-old woman with cerebral-vascular dementia.	7 10-minute sessions of acupuncture within 13 weeks, 10 with needles and 1 with a laser.	Improved cognitive function. Motor speech function, short memory, sleeping, and headaches were improved after the second treatment.	Austria.

Source	Research objective	Sample size	Intervention	Results	Research location
Huang and Yu [65]	To inquire into the effects of acupuncture on vascular dementia.	17 patients. Unspecified sex ratio and age range.	30-minute daily sessions, 10 times per course, 2 courses.	Significant improvements in cognition and quality of life.	China.
Lombardo, Dresser [74]	To investigate the effects of acupuncture on anxiety and depression in persons with Alzheimer's disease or vascular dementia.	11 patients. Unspecified sex ratio and age range.	3 30-minute times per week in the first week, 2-3 times a week in the 7 <sup>th</sup> -10 <sup>th</sup> weeks.	Improvements in anxiety and depression, but not significantly. Great improvements in energy.	USA.
Shen, Zhi [91]	To assess the effects of acupuncture with moxibustion on dementia.	90 patients, aged 53-86. Unspecified sex ratio.	Randomly assigned to 3 groups: Group 1, acupuncture and moxibustion (n=30); Group 2, medicine (n=30); and Group 3, acupuncture, moxibustion and medicine (n=30) groups. Acupuncture: 30-minute once a day, 15 days per course, 2 courses. Medicine: huperzine A tablets, 20mg, 3 times a day, 30 days.	Improved cognitive functions; 83% in Group 1, 67% in Group 2, and 93% in Group 3.	China.
Li, Zhuang [59]	To examine the effects of acupuncture on dementia.	30 patients (n=23 male, n=7 female), aged 54-80.	30-minute daily session, unspecified total sessions.	90% of patients showed improvements in cognition.	China.

#### **4. Recommendation**

Recommendations are discussed here regarding research and practical implications. Despite the results in this review which reported that dementia symptoms are mitigated by acupuncture or combined treatments, the sample sizes were usually less than 80 participants (n=29 projects). This lowers data reliability and negatively affects the representation and generalisation of the research outcomes. A larger sample size is suggested to gather robust data [104].

The effects of acupuncture on dementia have been demonstrated through this review. However, there is an absence of follow-up investigations [105], which causes difficulties in judging effect duration. Follow-up or longitudinal studies are therefore proposed to inquire into whether the effects of acupuncture are valid over the long-term.

Although there are randomised controlled trials in the reviewed projects (n=29), most of them did not detail their randomisation process or research design. It is justifiable to carry out well-designed randomised examinations to produce scientific and reliable data.

In light of Chinese medicinal theories, treatments are designed to meet individual needs. Thus, there is no protocol for acupuncture therapy [106] with different numbers of acupoints. If more elaboration on patterns of acupoint penetration had been presented, researchers could have studied in a more systematic manner.

Chinese medicine aims to strengthen life energy, focusing on prevention. Further study is therefore recommended on how acupuncture can delay the onset of dementia [107], which would optimise the advantages of acupuncture from the preventive perspective.

#### **5. Conclusion**

This narrative review analyses 44 clinical, human-based research projects conducted in Asia Pacific and North America with 3078 participants, aged 45-100. It offers an overview of how acupuncture can contribute to dementia by using acupuncture either singly or combined with other approaches. Acupuncture is comparatively safe and cost-effective when treatment is performed by a qualified, trained practitioner. According to this analysis, acupuncture is potentially effective in improving the cognition, memory, language, behaviour, emotions, and self-care of patients with dementia symptoms. It also proves that its combination with medications or other therapies can maximise these consequences. In short, acupuncture is suggested for preventive, remedial, and rehabilitative purposes; however, it does need further well-designed scientific research with more reliable data sets.

#### **Author Contributions**

The author is responsible for the entire process of writing up, revising, and approving the final version of this manuscript.

#### **Competing Interests**

There is no conflict of interest to declare with respect to the present manuscript submitted for publication.

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