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REVIEW

The parallel system: traditional, complementary and integrative therapies in neurorehabilitation in India

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Background: Disorders of the nervous system are now the leading cause of disability-adjusted life-years (DALYs) worldwide, accounting for 443 million DALYs and affecting 3.40 billion people, 43.1% of the world's population. In India, non-communicable neurological disorders' share of total DALYs doubled between 1990 and 2019, from 4.0% to 8.2%, with stroke alone accounting for 37.9% of neurological DALYs. Against this burden stands a second, parallel health system: 755,780 registered Ayush practitioners, 3,885 Ayush hospitals, and 12,500 Ayush Health and Wellness Centers, with public awareness of 94%–96% and national usage exceeding 50%. Most Indian patients with neurological disability use both systems, and almost none are managed by a clinician who knows what the other system is doing.

Objective: To appraise the current evidence for traditional, complementary, and integrative (TCI) therapies in neurorehabilitation in India, to separate what is demonstrated from what is asserted, and to propose a funded mechanism for integration anchored in the World Health Organization's (WHOs) ratified frameworks.

Methods: Narrative review with a structured search of PubMed, the Cochrane Library, and Europe PubMed central (PMC) from September 2026, supplemented by WHO policy documents, Ministry of Ayush reports, and Clinical Trials Registry-India records. Therapies were grouped as movement-based (yoga, tai chi, Baduanjin, dance, and Kalarippayattu), whole-system pharmacological (Ayurveda, Siddha, and Unani), single-agent phytotherapeutic (*Withania somnifera*, *Bacopa monnieri*, *Mucuna pruriens*, and *Centella asiatica*), needle- and pressure-based (acupuncture, acupressure, and marma), and manual/procedural (Panchakarma, Abhyanga, Shirodhara, and Kalari massage). Evidence was graded by design hierarchy, with particular attention to sham-controlled comparisons.

Results and Discussion: The evidence is uneven, and that unevenness is itself the main finding. Yoga has Class I evidence in epilepsy for reducing felt stigma, with significantly higher odds of >50% seizure reduction (OR 4.11, 95% CI 1.34–14.69) and of complete remission (OR 7.4, 95% CI 1.75–55.89) in a 160-patient sham-yoga-controlled Indian trial. Yoga in Parkinson's disease improves motor scores (UPDRS-III mean difference –5.64, 95% CI –8.57 to –2.70), balance, mood, and quality of life in meta-analysis and is non-inferior to stretching and resistance exercise, with an added psychological benefit. *Mucuna pruriens* met all non-inferiority efficacy and safety endpoints against dispersible levodopa/benserazide in advanced Parkinson's disease, with fewer dyskinesias. Conversely, yoga for stroke rehabilitation rests on two trials and 72 participants at very low GRADE certainty; acupuncture's apparent benefit in stroke disappears against sham; and the first randomized controlled trial of Ayurvedic rehabilitation in ischaemic stroke, AyuRvedic TrEatment in the Rehabilitation of Ischemic STrOke patients in India (a randomized controlled trial) (RESTORE) (140 patients across four Indian comprehensive

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stroke centers), found Ayurveda not superior to physiotherapy, with the unadjusted Fugl-Meyer upper-extremity score favoring physiotherapy. Safety is not a footnote: lead was detected in 65% of 252 Ayurvedic samples in one public health investigation, and *C. asiatica* alters valproate and phenytoin pharmacokinetics.

Conclusion: The question is no longer whether Indian patients will use traditional and complementary therapies during neurological recovery; they already do, at scale, usually without telling their neurologist. The question is whether Indian neurology will regulate, measure, and integrate that use or continue to ignore it. Integration is feasible and necessary, but only on the terms the evidence itself sets: yoga and structured movement therapies as adjuncts within the rehabilitation prescription now, single-agent phytotherapeutics under pharmacovigilance, and whole-system Ayurvedic rehabilitation inside registered trials until a positive one exists.

Keywords: neurorehabilitation, Ayurveda, yoga, traditional medicine, AYUSH, stroke rehabilitation

Introduction: two systems, one patient

Disorders the nervous system are the leading cause of disease burden on earth. The Global Burden of Disease Study 2021 attributed 443 million disability-adjusted life-years (DALYs) (95% UI 378–521) to 37 nervous-system conditions, affecting 3.40 billion people, 43.1% of the global population; the DALY count rose 18.2% between 1990 and 2021 (1). India carries a disproportionate and shifting share of this burden. Between 1990 and 2019, non-communicable neurological disorders' share of Indian DALYs doubled from 4.0% to 8.2%, and injury-related neurological disorders trebled from 0.2% to 0.6%. Stroke contributed 37.9% of neurological DALYs, headache disorders 17.5%, epilepsy 11.3%, cerebral palsy 5.7%, and encephalitis 5.3%. The crude DALY rate for stroke varied 5.5-fold between Indian states (2).

Survival is not the endpoint in any of these conditions; function is. Function in India is delivered by a rehabilitation system that does not exist at the scale the burden demands, a gap this author and colleagues have documented in the context of the national stroke program, telerehabilitation, and India's progress against the World Health Organization (WHO) *Rehabilitation 2030* targets (3–6). A nationwide survey of 872 neurorehabilitation professionals conducted by the Indian Federation of Neurorehabilitation found that most rehabilitation units lacked a physiatrist, a rehabilitation nurse, a cognitive therapist, and a music therapist; advanced rehabilitation technology was available in only about 20% of units; and 24% of patients who needed neurorehabilitation received no therapy at all (7). A patient who receives nothing from the formal system does not wait quietly. She goes elsewhere.

Into that gap steps a second system. India has 755,780 registered Ayush practitioners, 3,885 Ayush hospitals with more than 62,000 beds, 932 Ayush colleges admit approximately 70,000 undergraduates annually, and 12,500 Ayush Health and Wellness Centers (Ayushman Arogya Mandirs) are integrated across 26,636 Primary Health Centers, 6,155 Community Health Centers and 759 District Hospitals. Public awareness of Ayush systems stands at 94%–96%, and reported usage exceeds 50% nationally (8). Beneficiaries at these Wellness Centers rose from 1.5 crore in 2021 to 8.9 crore in 2023 (9).

These two systems treat the same patient and rarely speak to one another. A woman in Thrissur recovering from a middle cerebral artery infarct may receive intravenous thrombolysis on day zero, physiotherapy for 3 weeks, and then 28 days of Panchakarma at a facility her neurologist never hears about; her Ayurvedic physician has no Fugl-Meyer score for her, and neither clinician records an International Classification of Functioning, Disability and Health (ICF) category. The result is parallel invisibility, not integration—the single largest unmeasured variable in Indian neurorehabilitation.

This paper's purpose is to measure traditional and complementary practice in Indian neurorehabilitation, not to advocate for it. The World Health Assembly has now given that project its scaffolding: resolution WHA76.6 on strengthening rehabilitation in health systems (2023) (10) and the Global Traditional Medicine Strategy 2025–2034, adopted by the Seventy-eighth World Health Assembly and published in October 2025, whose four strategic objectives are to strengthen the evidence base for traditional, complementary, and integrative (TCI) medicine; ensure its safety and regulation; integrate it into health systems; and optimize its cross-sectoral value (11). India cannot claim leadership in traditional medicine while declining to generate the evidence that the strategy it voted for demands.

Methods

This is a narrative review, not a systematic review, and is reported as such.

PubMed, the Cochrane Database of Systematic Reviews, and Europe PubMed central (PMC) were searched from September 2026 using combinations of *yoga*, *Ayurveda*, *Panchakarma*, *acupuncture*, *acupressure*, *tai chi*, *Baduanjin*, *dance therapy*, *meditation*, *mindfulness*, *traditional medicine*, *complementary medicine*, *Ayurveda, Yoga and Naturopathy, Unani, Siddha, and Homoeopathy (AYUSH),*

and *phytotherapy*, each combined with *neurorehabilitation*, *stroke rehabilitation*, *Parkinson's disease*, *epilepsy*, *multiple sclerosis*, *spinal cord injury*, *traumatic brain injury*, *cerebral palsy,* and *muscular dystrophy*. Priority was given, in order, to Cochrane reviews, meta-analyses of randomized controlled trials, and individual randomized controlled trials. Case reports were included only where they represent the entire published evidence for a practice in wide clinical use and are labeled as such.

Policy material was drawn from WHO documents, the Ministry of Ayush annual report, and Clinical Trials Registry-India (CTRI) records. Where a therapy is widely practiced but has generated no controlled evidence, that absence is stated rather than filled with a mechanism.

Three judgements govern the appraisal throughout. First, a sham comparison is worth more than a waiting-list comparison: rehabilitation interventions carry large expectancy effects, and a trial that compares an intervention with nothing measures attention, contact time, and hope as much as the intervention itself. Second, whole-system interventions and single-agent interventions require different designs; a Panchakarma protocol comprising seven oral preparations and four procedures cannot be evaluated by the method appropriate to a standardized *Bacopa* extract, and evaluating it as though it could have produced much of the confusion in this field. Third, function is the outcome that matters: trials reporting only symptom scales, and not activity or participation, answer a smaller question than rehabilitation asks.

Traditional and complementary practice in Indian neurorehabilitation

Ayurveda and Panchakarma

Ayurveda approaches neurological deficit through the *Vata* framework, and its rehabilitative arm is largely Panchakarma: *Abhyanga* (medicated oil massage), *Pinda Sweda*/*Shashtika Shali Pinda Sweda* (sudation with boluses of medicated rice), *Basti* (medicated enema, including *Matra Basti*, *Kaala Basti*, and *Yapana Basti*), *Shirodhara* and *Shiro Basti* (scalp and forehead oil procedures), and *Greeva Basti* (retention of warm medicated oil over the cervical spine). Oral polyherbal and herbo-mineral preparations, including *Dashamoola Kwatha*, *Brihat Vata Chintamani Rasa*, *Ashwagandha Churna*, *Trayodashanga Guggulu*, and *Amrita* (*Tinospora cordifolia*), are given concurrently.

Yoga

Yoga is the most widely practiced and most extensively studied of India's traditional therapies in the neurological context. Several distinguishable forms are used in rehabilitation, a distinction that matters for interpreting trials: *asana*-dominant therapeutic yoga with props and supports in the Iyengar tradition, which permits practice by patients who cannot weight-bear; *pranayama*-dominant breath regulation; meditation- and mindfulness-dominant protocols; and mixed protocols combining all three with relaxation (*Shavasana*, *Yoga Nidra*). The Iyengar method's use of belts, bolsters, ropes, and tilt tables to make postures accessible to disabled practitioners is, in rehabilitation terms, orthotic adaptation, and it is what allows postures such as *Supta Baddha Konasana* and supported *Tadasana* to be prescribed in Parkinson's disease and multiple sclerosis.

Other Indian traditions

Kalarippayattu, the Kerala martial tradition, incorporates *Kalari* massage (*Uzhichil*), performed by hand (*Samvahana*), by foot with graded body weight (*Utsadana*), or by two therapists simultaneously (*Suparithala Kriya*), combined with graded physical exercise, *pranayama*, and meditation. Marma therapy applies pressure at defined anatomical points. Naturopathy contributes hydrotherapy, mud therapy, and dietetics. Siddha and Unani maintain their own pharmacopoeias and manual techniques. Acupuncture, though Chinese in origin, is practiced widely in India and recognized under the Ministry of Ayush framework.

The community model

None of this is delivered in a vacuum. The Parkinson's Disease and Movement Disorder Society's community-based multidisciplinary model in Mumbai, combining group physiotherapy, speech therapy, yoga, dance, art therapy, nutrition counseling and peer support in neighborhood halls rather than hospitals, demonstrates the delivery architecture that suits India: low-cost, close to home, and group-based. That architecture is why traditional therapies reach patients whom formal rehabilitation services do not. It is also why they are not measured.

The evidence, therapy by therapy

Yoga in epilepsy: the strongest case

Yoga in epilepsy has moved, within the last 3 years, from plausible to evidenced, and the decisive trial is Indian.

The Cochrane review of yoga for epilepsy, last updated in 2017, found only two unblinded trials totalling 50 participants. Pooled odds of more than 50% seizure reduction favored yoga over sham yoga (OR 81.00, 95% CI 4.36–1504.46) and over no treatment (OR 158.33, 95% CI

5.78–4335.63), but the wide confidence intervals told the real story: the evidence was graded low, and the authors concluded that no reliable inference was possible (12).

That changed with the assessor-blinded, sham-yoga-controlled randomized trial of Kaur and colleagues, published in *Neurology* in 2023 (13). One hundred and sixty adults with epilepsy scoring above the cut-off for felt stigma on the Kilifi Stigma Scale were randomized to yoga plus psychoeducation or sham yoga plus psychoeducation for 3 months, with follow-up to 6 months. Felt stigma fell significantly in the intervention arm, which also showed significantly higher odds of more than 50% seizure reduction (OR 4.11, 95% CI 1.34–14.69, p = 0.01) and of complete seizure remission (OR 7.4, 95% CI 1.75–55.89, p = 0.005), together with improvements in anxiety, cognition, mindfulness, and quality of life. The trial provides Class I evidence that yoga reduces felt stigma in adults with epilepsy.

Two features make this trial matter beyond its primary endpoint. The comparator was sham yoga, not a waiting list: postural exercises mimicking yoga without its breath and attentional components. And the primary outcome, stigma, is a participation-level construct in ICF terms that conventional antiseizure medication does not touch. In a country where stigma, not seizure frequency, determines whether a young woman with epilepsy completes her education or marries, that is the clinically relevant outcome.

Pediatric data remain thin but directionally consistent: in a small Indian randomized trial of 20 children aged 8–12 years, no child in the yoga arm had seizures at 3 or 6 months, and electroencephalogram (electroencephalography) (EEG) abnormality persisted in 1 of 10 in the yoga group versus 7 of 10 controls at 6 months (p = 0.020) (14). The sample is too small to carry weight on its own and should be read as a signal for replication, not as practice-changing. A registered Indian protocol for a double-blind randomized trial of yoga in refractory epilepsy, using EEG, World Health Organization Quality of Life, Brief version (WHOQOL-BREF), and seizure frequency as outcomes, was published in 2020 by this author and colleagues (15); the field needs its completion and reporting, as it needs completion of every protocol of this kind.

Yoga and mind-body movement in Parkinson's disease: consistent, moderate, real

Parkinson's disease is where mind-body movement therapy has the most coherent evidence base.

A meta-analysis of 10 randomized trials including 359 participants found yoga superior to control across every domain measured: motor signs (UPDRS-III mean difference −5.64, 95% CI −8.57 to −2.70), balance (SMD 0.42, 95% CI 0.08 to 0.77), functional mobility on timed-up-and-go (MD −1.71, 95% CI −2.58 to −0.84), anxiety (SMD −0.72), depression (SMD −0.92), and quality of life (SMD −0.54) (16).

The most methodologically robust single trial is Kwok and colleagues' assessor-masked randomized trial in *JAMA Neurology*, comparing an 8-week mindfulness yoga program against stretching and resistance-training exercise in 138 patients with mild-to-moderate Parkinson's disease (17). Yoga was as effective as conventional exercise for motor dysfunction and mobility, with additional and sustained benefit at 20 weeks for anxiety (β −2.05, 95% CI −3.02 to −1.08), depression (β −2.75, 95% CI −3.71 to −1.79), perceived hardship, equanimity, and disease-specific quality of life. The correct clinical takeaway is that yoga matches conventional exercise for moving the body and does more for the mind that inhabits it.

The Cochrane network meta-analysis of physical exercise in Parkinson's disease (154 trials, 7,837 participants) places this in context. Dance produced the largest effect on motor signs (MD −10.18, 95% CI −14.87 to −5.36, moderate confidence), with gait, balance, and functional training close behind (MD −7.50); mind-body training showed a small beneficial effect (MD −3.62, 95% CI −7.24 to 0.00, low confidence) and a small benefit on quality of life (MD −7.22, 95% CI −13.57 to −0.70) (18). The authors' conclusion is refreshingly modest: most exercise types help, and the differences between them are small. The exercise a patient will actually do every week beats the exercise that scores marginally higher in a trial they will never enter. In India, that is frequently yoga, because it requires no equipment, no gymnasium, no transport, and carries no cultural friction.

Supporting single trials are consistent: an 8-week yoga intervention improved non-motor symptoms (19); Hatha yoga improved standing balance though not gait (20); yoga meditation improved proprioception and balance (21); and high-speed yoga was comparable to power training for motor function in older patients (22). Tai chi, from the Chinese tradition but widely taught in India, reduced balance impairment and falls in the landmark *New England Journal of Medicine* trial (23), and dance-based protocols show reproducible motor benefit (24, 25).

Yoga in stroke rehabilitation: the weakest link in the most important condition

Stroke contributes 37.9% of India's neurological DALY burden (2). It is also where the evidence for yoga is thinnest, a mismatch that should govern research priorities directly.

The Cochrane review of yoga for stroke rehabilitation identified two randomized trials totalling 72 participants (26). Balance on the Berg Balance Scale did not differ significantly (MD 2.38, 95% CI −1.41 to 6.17). Of six Stroke Impact Scale domains, only memory reached significance (MD 15.30, 95% CI 1.29–29.31). State anxiety improved (STAI-Y1 MD −8.40, 95% CI −16.74 to −0.06). Gait speed, motor function, and disability showed no significant effect. All findings were graded very low certainty, and no adverse events were reported. The authors' conclusion, that

yoga has potential for inclusion in patient-centerd stroke rehabilitation but that the evidence is insufficient to confirm or refute effectiveness, remains accurate.

Since that review, a non-inferiority randomized trial in 36 patients with chronic post-stroke sequelae found a yoga program non-inferior to a conventional fitness and mobility exercise program for balance, functional mobility, and muscle strength, with both arms improving in anxiety, depression, and reintegration to normal living (27). A meta-analysis of mind-body movements for balance in stroke survivors reports benefit but shares the same small-sample limitation (28).

The safety signal is reassuring; the efficacy signal is simply missing because the trial has not been done. India, with its stroke burden, its yoga infrastructure, and a functioning national stroke trials network (29), is the country best placed to fix this.

Yoga in multiple sclerosis, muscular dystrophy, and spinal cord injury

Multiple sclerosis rehabilitation in the Indian setting has been reviewed previously by this author: inpatient, outpatient, and home-based multidisciplinary programs all reduce disability, and family-based rehabilitation is central to any program intended to run for years rather than weeks (30). Yoga sits naturally inside that framing as a home-deliverable component, but it must be positioned against what disease-modifying therapy now achieves in Indian cohorts: in a multicenter ambispective study across 18 Indian centers, natalizumab reduced the annualized relapse rate from 3.1 ± 1.51 to 0.20 ± 0.57 ($p = 0.001$), with no case of progressive multifocal leukoencephalopathy at last follow-up (31). "Adjunct" means "alongside," "not instead."

A meta-analysis of 10 randomized trials including 693 patients found yoga significantly better than usual care for fatigue (SMD −0.872, 95% CI −1.467 to −0.277, $p = 0.004$) but no better than conventional exercise (SMD −0.093, 95% CI −0.353 to 0.167), with no significant effect on overall quality of life (32). A three-arm randomized trial comparing Iyengar-method yoga, physical therapy, and a waiting list found no difference in balance, walking, or fatigue between the active arms, but significant advantages for yoga on four SF-36 domains: physical functioning, vitality, mental health, and social functioning (33). A 2025 systematic review of 26 randomized trials across autoimmune disorders, including 1,960 patients, reported positive evidence for fatigue, balance, quality of life, and depression in multiple sclerosis with no adverse events (34). Baduanjin outperformed yoga on balance, trunk control, and depression in one three-arm trial (35), a finding worth replicating rather than accepting.

In Duchenne muscular dystrophy, the published evidence amounts to a single uncontrolled observational report of 16 patients given 18 months of yoga and Ayurvedic medication, of whom ten completed follow-up and three practiced regularly, with reported improvement in mobility, self-care, and respiratory ease in those three (36). This is hypothesis-generating and nothing more and should be cited as such. For spinal cord injury and traumatic brain injury, no adequately powered randomized trial of yoga or Ayurvedic rehabilitation exists.

Whole-system Ayurvedic rehabilitation: the first randomized controlled trial, and what it found

For two decades the Ayurvedic rehabilitation literature in neurology consisted almost entirely of case reports. Two are widely cited and worth stating accurately, because they illustrate both the promise and the problem. Rastogi reported a single case of traumatic spinal cord injury followed for 3 months on a composite Ayurvedic intervention of oral medication plus external and internal Panchakarma procedures, with substantial improvement in neurological deficit and patient-centerd outcomes (37). Singh and Rajoria reported a single case of C4-level spinal cord injury treated for 2 months with seven oral preparations and a sequence of *Shashtika Shali Pinda Sweda*, *Matra Basti*, and *Mustadi Yapana Basti*, again with substantial reported clinical improvement (38). Both are honestly reported. Neither can distinguish treatment effect from spontaneous neurological recovery, which in the first months after spinal cord injury is substantial and expected.

That gap has now been addressed. The AyuRvedic TrEatment in the Rehabilitation of Ischemic STrOke patients in India (a randomized controlled trial) (RESTORE) trial (investigator-initiated, multicenter, prospective, parallel-arm, with blinded outcome assessment across four comprehensive stroke centers in India) randomized 140 patients with first-ever ischemic stroke 1:1 to Ayurvedic Rehabilitation Therapy or physiotherapy (39, 40). The primary outcome was sensorimotor recovery of the upper extremity on the Fugl-Meyer Assessment. At 3 months the unadjusted Fugl-Meyer Assessment, Upper Extremity (FMA-UE) score was significantly better in the physiotherapy arm (81.97 ± 24.57 vs. 71.97 ± 23.88, $p = 0.023$); after adjustment for age, stroke severity, baseline FMA-UE, and risk factors, the difference was no longer significant ($p = 0.057$). No secondary outcome, whether functional disability, activities of daily living, postural balance, or quality of life, favored the Ayurveda arm, and no major serious adverse events occurred.

RESTORE is a landmark, and its authors deserve credit for running it. Read plainly, it is also a negative trial for the hypothesis tested: the Ayurvedic rehabilitation protocol as delivered was not superior to physiotherapy, and the unadjusted primary outcome favored physiotherapy. The

accompanying process evaluation is essential reading for anyone designing the next trial (40).

Two responses to RESTORE are available. One is to argue that the protocol was not the right protocol, that individualization was constrained by trial design, or that 3 months is too short; some of that may be true, and the process evaluation addresses it, but that argument can only be made once, and only if followed by a better-designed trial. The other response, the one this paper urges, is to accept the result, stop asserting superiority, and reposition whole-system Ayurvedic rehabilitation as an adjunct under investigation rather than an established therapy. Anything short of that is a refusal to be measured, not tradition. A registered Indian randomized trial of Ayurvedic interventions plus yoga for the long-term effects of COVID-19 provides a template for whole-system trial design with adequate registration and reporting (41).

Single-agent phytotherapeutics: where Indian pharmacology is strongest

Where Ayurveda has been reduced to a standardized single agent with a defined dose, the evidence improves markedly.

Mucuna pruriens is the outstanding example and a genuine Indian contribution to global movement disorder practice. In an 18-patient double-blind randomized crossover study in advanced Parkinson's disease, single-dose *M. pruriens* powder from roasted seeds met all non-inferiority efficacy and safety outcomes against dispersible levodopa/benserazide; the high dose produced greater motor improvement at 90 and 180 minutes, longer ON duration, fewer dyskinesias, and fewer adverse events (42). This followed an earlier double-blind pharmacological study demonstrating faster onset and longer ON time without increased dyskinesia (43). A 16-week non-inferiority crossover study of daily intake in advanced disease (44) and a 2025 randomized controlled trial comparing *M. pruriens* with conventional levodopa in an Asian population (45) extend the evidence, and practical guidelines for cultivation-to-clinic use in low-income countries have now been published (46). For a patient in rural India priced out of marketed levodopa, *M. pruriens* functions as pharmacology with a different supply chain, and it warrants the same rigor: standardized levodopa content, a known dose, and pharmacovigilance.

Withania somnifera (Ashwagandha) has randomized evidence for cognition and stress rather than for neurorehabilitation specifically. A randomized, double-blind, placebo-controlled trial in 50 adults with mild cognitive impairment found 300 mg of root extract twice daily for 8 weeks improved immediate and general memory on Wechsler Memory Scale subtests, together with executive function, sustained attention, and processing speed (47). A meta-analysis of nine randomized trials including 558 patients found significant effects on the Perceived Stress Scale (MD −4.72, 95% CI −8.45 to −0.99), the Hamilton Anxiety Scale (MD −2.19, 95% CI −3.83 to −0.55), and serum cortisol (MD −2.58, 95% CI −4.99 to −0.16), with mild-to-moderate adverse events in four studies (48). A dose-ranging randomized trial confirmed stress reduction at doses from 125 mg daily (49), and an 80-participant randomized safety study found no hematological, biochemical, or thyroid abnormalities over 8 weeks (50). The pharmacological and toxicological literature is extensive (51, 52). What does not yet exist is a trial of *W. somnifera* in post-stroke or post-traumatic cognitive rehabilitation, where the mechanistic rationale is strongest.

Bacopa monnieri (Brahmi) improved delayed word recall and Stroop performance in a randomized placebo-controlled trial of 54 healthy elderly participants over 12 weeks (53), with acute dose-finding data (54) and neuroimaging correlates in older adults (55). Again: no neurorehabilitation trial exists. *Centella asiatica* is discussed in Section 6, in the context of drug interactions.

Acupuncture and acupressure: the sham problem, stated plainly

The Cochrane review of acupuncture for stroke rehabilitation included 31 trials and 2,257 participants in the subacute or chronic phase (56). Compared with no acupuncture, acupuncture plus baseline treatment improved the Barthel Index (MD 9.19, 95% CI 4.34–14.05), global neurological deficit (OR 3.89, 95% CI 1.78–8.49), Fugl-Meyer motor score (MD 6.16, 95% CI 4.20–8.11), Mini-Mental State Examination (MD 2.54, 95% CI 0.03–5.05), Hamilton Depression Scale (MD −2.58, 95% CI −3.28 to −1.87), swallowing and pain. But in the two trials that compared real acupuncture with sham acupuncture, there was no evidence of a difference in motor function or quality of life. Certainty was low to very low throughout, and the authors concluded there is inadequate evidence to recommend routine use.

Subsequent meta-analyses of abdominal acupuncture for motor recovery (57), acupuncture for post-stroke cognitive impairment (58), scalp acupuncture (59), transcutaneous electrical acupoint stimulation for upper-limb recovery (60) and post-stroke depression (61) all report benefit, and all share the same structural weakness: a predominance of small, unblinded, single-country trials with inadequate sham control. Until a large multicenter sham-controlled trial exists, acupuncture in stroke rehabilitation should be described to patients as a low-risk adjunct of uncertain specific efficacy, and no more.

Massage, Panchakarma procedures and Kalari: evidence absent, not evidence negative

Abhyanga, *Shirodhara*, *Pinda Sweda*, *Kalari* massage and marma therapy are in daily use across India for spasticity, pain, stiffness and sleep disturbance after neurological injury. No randomized controlled trial of any of them, as a rehabilitation intervention in a neurological population, meets contemporary methodological standards.

Absence of evidence is not evidence of absence, but neither is it a license to claim effect. Manual therapy and passive movement have plausible mechanisms in spasticity and contracture prevention, the interventions are inexpensive, the safety profile is favorable in competent hands, and patients report benefit—a strong case for trials, not for claims.

Why the evidence is weak, and how to fix it

Six recurring failures explain most of the weakness in this literature, and each has a known remedy.

The whole-system problem

A Panchakarma protocol with seven oral preparations and four procedures cannot be dismantled by a design built for single agents; attempting it produces either an uninterpretable trial or a protocol so simplified that practitioners disown the result. Whole-system research designs, pragmatic trials with pre-specified individualization rules, and stepped-wedge designs at the facility level are the remedy. RESTORE's process evaluation demonstrates how to capture what actually happened inside a whole-system arm (40).

Sham control is avoided

Most yoga and Ayurveda trials use waiting-list or usual-care comparators, which cannot separate the intervention from attention and expectancy. The Kaur trial shows that credible sham yoga is constructible (13); there is no longer an excuse for avoiding it.

Outcomes are not anchored to function

Trials report symptom scales and rarely activity or participation. The International Classification of Functioning, Disability, and Health provides a common language across biomedical and traditional systems because it describes function rather than diagnosis and should be mandatory in this field (62). The Kaur trial's use of felt stigma as a primary outcome is a model.

Sample sizes are small, and trials are single-center

Cochrane's yoga-for-stroke review rests on 72 participants across two trials (26). Yoga-CaRe proved that India can recruit 3,959 patients across 24 centers into a mind-body rehabilitation trial and report it in a major cardiology journal (63). The obstacle is intent, not feasibility.

Registration and reporting are inconsistent

Publication in journals not indexed in MEDLINE or Embase renders findings invisible to systematic reviewers, and unregistered trials cannot be audited for outcome switching. Every AYUSH trial in a neurological population should be registered on CTRI before first enrolment and reported to Consolidated Standards of Reporting Trials (CONSORT), with the relevant extension.

Negative results are not published

Until RESTORE, the Indian Ayurveda-in-stroke literature was uniformly positive and uniformly uncontrolled. That is a signature of publication bias, not of efficacy.

Safety, regulation and the duty to ask

Three safety domains require the neurologist's attention, and all three are routinely neglected.

Heavy metal contamination

In a systematic sampling of 70 Ayurvedic herbal medicine products sold in South Asian stores, 20% contained detectable lead, mercury or arsenic, with lead concentrations up to 37,000 μg/g and mercury up to 104,000 μg/g; each contaminated product, taken as directed, would have produced intakes above regulatory standards (64). A later investigation of a lead-poisoning cluster analysed 252 Ayurvedic samples and found lead in 65%, mercury in 38% and arsenic in 32%, with a substantial proportion exceeding recommended daily intake limits for pharmaceutical impurities by several thousand times (65). Some *rasaushadhi*

preparations contain metals by design following *shodhana* and *marana* purification; the claim that these are rendered non-toxic has not been established to contemporary toxicological standards. A patient with new encephalopathy, peripheral neuropathy or abdominal pain who takes Ayurvedic preparations warrants a blood lead level as a matter of course.

Herb-drug interactions

These are unstudied in humans and demonstrably real in animals. Hydroalcoholic *C. asiatica* extract co-administered with sub-therapeutic valproate and phenytoin in rat seizure models enhanced seizure protection but significantly increased serum concentrations of both drugs and altered C-max, area under the curve (AUC), and clearance; the authors explicitly caution that medical supervision is required to avoid toxicity (66). *Centella asiatica* (*Mandukaparni*) is among the most commonly used Ayurvedic nootropics in India, and it is used by people with epilepsy. The interaction literature for *W. somnifera* likewise flags the need for study alongside pharmaceutical treatment (51). Any patient on narrow-therapeutic-index antiseizure medication who begins an herbal preparation needs drug-level monitoring.

Delay and substitution

The greatest harm from traditional therapy in neurology is rarely the therapy itself; it is time. A patient who takes oral Ayurvedic preparations for 2 weeks after a transient ischemic attack, or who defers epilepsy surgery evaluation in favor of a Panchakarma course loses a window that does not reopen. The point is not to reject traditional medicine but to have a conversation about it, and that conversation does not currently happen, because clinicians do not ask.

The single most implementable recommendation in this paper costs nothing: add one line to the neurological history. "What else are you taking, and who else are you seeing?" Ask it without judgement, and record the answer. Patients conceal traditional medicine use because they expect ridicule. Concealment, not use, is what makes it dangerous.

A model for integration

Integration must be specified, or it is a slogan. The mandate already exists: the WHO Intersectoral Global Action Plan on Epilepsy and Other Neurological Disorders 2022–2031 requires member states to produce national plans covering the full care pathway, rehabilitation included (67), and a regional academic network for physical and rehabilitation medicine across Asia-Oceania has been proposed to carry exactly this kind of work (68). Four elements make integration operational.

The ICF as the shared language

Biomedical and traditional systems do not share a nosology and never will, but they can share a description of function. Mandating ICF-anchored documentation at every point where an Ayush practitioner treats a patient with neurological disability, beginning with Ayushman Arogya Mandirs, creates, for the first time, a common record.

Placement in the rehabilitation pathway, by evidence tier

The evidence supports differential placement, not blanket endorsement, as summarized in **Table 1**.

The Ayushman Arogya Mandir as delivery platform

India already has the largest community traditional-medicine delivery platform in the world (8, 9). It is currently used for wellness; it could deliver supervised group yoga for epilepsy and Parkinson's disease at the district level, at marginal cost, with ICF outcomes captured at the point of delivery.

Telerehabilitation as reach multiplier

Low-cost telerehabilitation has already extended neurorehabilitation into settings with no rehabilitation workforce (3, 69, 70), and yoga is among the few rehabilitation interventions that transmits well over low bandwidth, requiring no equipment at the patient's end. Supervised group tele-yoga for post-stroke and Parkinson's disease cohorts is the obvious next pragmatic trial, and one India is uniquely placed to run.

Recommendations

Each recommendation below names a mechanism, an owner and a deliverable; none of them is "more research is needed."

1. Establish a National AYUSH–Neurorehabilitation Trials Consortium, jointly convened by the Indian Council of Medical Research, the Ministry of Ayush and the Indian Federation of Neurorehabilitation, with a 5-year funded portfolio of at least four adequately powered multicenter randomised controlled trials: tele-delivered yoga in post-stroke rehabilitation;

TABLE 1 | Evidence-based tiers for placing traditional and complementary therapies in the neurorehabilitation pathway.

Tier	Recommendation	Therapies
1	Prescribe now, as adjunct	Yoga (asana, pranayama, meditation) in epilepsy, Parkinson's disease, and multiple sclerosis; structured group movement, including dance, in Parkinson's disease
2	Permit with monitoring	Standardized single-agent phytotherapeutics with defined content, notably *M. pruriens* in Parkinson's disease, where levodopa access is limited, under pharmacovigilance and drug-level monitoring where interaction is plausible
3	Inside registered trials only	Whole-system Ayurvedic rehabilitation protocols in stroke, spinal cord injury, and traumatic brain injury; acupuncture for motor recovery; Panchakarma procedures for spasticity
4	Do not substitute, ever	Acute stroke management, status epilepticus, and any condition with a time-critical proven intervention

yoga in drug-resistant epilepsy (confirmatory, following Kaur et al.); *M. pruriens* in Parkinson's disease in rural Indian cohorts; and a whole-system Ayurvedic protocol in spasticity, designed with the RESTORE investigators.

2. Mandate ICF-anchored outcome reporting in every AYUSH clinical trial and service record involving a patient with neurological disability, beginning with Ayush Health and Wellness Centers, and mandate CTRI registration before first enrolment for all such trials.
3. Establish an AYUSH neuro-pharmacovigilance cell within the existing Pharmacovigilance Program of India, with a defined reporting pathway for suspected herb-drug interactions and heavy metal toxicity in neurological patients, and a published annual report.
4. Make heavy metal screening a condition of licensure for any Ayurvedic, Siddha, or Unani preparation marketed for a neurological indication, with batch-level certificates of analysis published in a public registry.
5. Add traditional and complementary medicine use to the standard neurological history in all Indian residency curricula, national guidelines, and society templates, including those of the Indian Academy of Neurology, the Indian Stroke Association, and the Indian Federation of Neurorehabilitation, with the disclosure recorded in the case record.
6. Fund a national cadre of neurorehabilitation-trained yoga therapists, with a defined competency, curriculum, and pay scale, placed in district hospitals and Ayushman Arogya Mandirs and reporting to the rehabilitation team rather than working parallel to it.

Conclusion

India's traditional systems are not a heritage exhibit. They are an operating health service of three-quarters of a million practitioners that treats, every day, the same patients with epilepsy, stroke, Parkinson's disease, and spinal cord injury whom neurologists treat, usually without either clinician knowing what the other has prescribed.

The evidence assembled here supports neither triumphalism nor dismissal. Yoga in epilepsy now carries Class I evidence for a participation-level outcome that antiseizure medication does not address. Yoga in Parkinson's disease is equivalent to conventional exercise for motor function and better for mood and quality of life. *Mucuna pruriens* is non-inferior to levodopa with fewer dyskinesias and affordable where levodopa is not. Against that: yoga in stroke rests on 72 participants; acupuncture's benefit vanishes against sham; and the first randomized controlled trial of Ayurvedic rehabilitation in stroke found it not superior to physiotherapy. One in five Ayurvedic products sampled contained heavy metals.

The honest position is a graded one, and graded positions are harder to hold than either enthusiasm or contempt. But the alternative, a biomedical system that does not ask and a traditional system that is not measured, serves no patient in either.

The bottom line

A therapy that half of India already uses is not exempt from evidence because it is old, nor disqualified from evidence because it is traditional. Integration is feasible and necessary, but it begins with a question in the consulting room and ends with a trial that India, uniquely, is equipped to run.

Data availability statement

Not applicable; all sources cited are published.

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Conflict of interest

The author declares that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

References

1. GBD 2021 Nervous System Disorders Collaborators. Global, regional, and national burden of disorders affecting the nervous system, 1990–2021: a systematic analysis for the Global Burden of Disease Study 2021. *Lancet Neurol.* (2024) 23(4):344–81. doi: 10.1016/S1474-4422(24)00038-3
2. India State-Level Disease Burden Initiative Neurological Disorders Collaborators. The burden of neurological disorders across the states of India: the Global Burden of Disease Study 1990–2019. *Lancet Glob Health.* (2021) 9(8):e1129–44. doi: 10.1016/S2214-109X(21)00164-9
3. Surya N, Someshwar HP. Low-cost telerehabilitation in low- and middle-income countries (LMICs): overcoming barriers to access and improving healthcare delivery. *NeuroRehabilitation.* (2025) 56(1):30–6. doi: 10.1177/10538135241303349
4. Surya N, Srivastava A, Ganvir S, Kumar S, Gandhi D, Chitnis S, et al. *Position Paper: Advancing Neurorehabilitation in India and Key Steps to Reach WHO's Rehab 2030 Goals*. Mumbai: Indian Federation of Neurorehabilitation (2024).
5. Kamalakannan S, Srivastava A, Chockalingam M, Gandhi D, Dhamija RK, Solomon J, et al. Health systems for rehabilitation — critical appraisal of the national programme for stroke in India. *J Indian Fed Neurorehabil.* (2024) 1(1):18–26.
6. World Health Organization. *Rehabilitation 2030: A Call for Action*. Geneva: World Health Organization (2017).
7. Surya N, Srivastava A, Nagda T, Palande D, Someshwar H. Education, training, and practices of neurorehabilitation in India during the COVID-19 pandemic. *Front Neurol.* (2021) 12:626399. doi: 10.3389/fneur.2021.626399
8. Nesari T, Nesari M, Ruknuddin G, Yadava RK, Huddar V, Dharmarajan P, et al. India's journey in mainstreaming Ayush in primary health care — from tradition to integration. *Front Med.* (2025) 12:1629515. doi: 10.3389/fmed.2025.1629515
9. Ministry of Ayush, Government of India. *Annual Report 2023–24*. New Delhi: Ministry of Ayush (2024).
10. Seventy-Sixth World Health Assembly. *Resolution WHA76.6: Strengthening rehabilitation in health systems*. Geneva: World Health Organization (2023).
11. World Health Organization. *Global Traditional Medicine Strategy 2025–2034*. Geneva: World Health Organization (2025).
12. Panebianco M, Sridharan K, Ramaratnam S. Yoga for epilepsy. *Cochrane Database Syst Rev.* (2017) 10(10):CD001524. doi: 10.1002/14651858.CD001524.pub3
13. Kaur K, Sharma G, Dwivedi R, Nehra A, Parajuli N, Upadhyay AD, et al. Effectiveness of yoga intervention in reducing felt stigma in adults with epilepsy: a randomized controlled trial. *Neurology.* (2023) 101(23):e2388–400. doi: 10.1212/WNL.0000000000207944
14. Kanhere SV, Bagadia DR, Phadke VD, Mukherjee PS. Yoga in children with epilepsy: a randomized controlled trial. *J Pediatr Neurosci.* (2018) 13(4):410–5. doi: 10.4103/JPN.JPN_88_18
15. Surya N, Someshwar H, Patil B, Sharma D. A study protocol to evaluate effect of yoga in people with epilepsy. *Acta Sci Neurol.* (2020) 3(6):47–50.
16. Ban M, Yue X, Dou P, Zhang P. The effects of yoga on patients with Parkinson's disease: a meta-analysis of randomized controlled trials. *Behav Neurol.* (2021) 2021:5582488. doi: 10.1155/2021/5582488
17. Kwok JYY, Kwan JCY, Auyeung M, Mok VCT, Lau CKY, Choi KC, et al. Effects of mindfulness yoga vs stretching and resistance training exercises on anxiety and depression for people with Parkinson disease: a randomized clinical trial. *JAMA Neurol.* (2019) 76(7):755–63. doi: 10.1001/jamaneurol.2019.0534
18. Ernst M, Folkerts AK, Gollan R, Lieker E, Caro-Valenzuela J, Adams A, et al. Physical exercise for people with Parkinson's disease: a systematic review and network meta-analysis. *Cochrane Database Syst Rev.* (2024) 4(4):CD013856. doi: 10.1002/14651858.CD013856.pub3
19. Walter AA, Adams EV, Van Puymbroeck M, Crowe BM, Urrea-Mendoza E, Hawkins BL, et al. Changes in nonmotor symptoms following an 8-week yoga intervention for people with Parkinson's disease. *Int J Yoga Therap.* (2019) 29(1):91–9. doi: 10.17761/2019-00025
20. Elangovan N, Cheung C, Mahnan A, Wyman JF, Tuite P, Konczak J. Hatha yoga training improves standing balance but not gait in Parkinson's disease. *Sports Med Health Sci.* (2020) 2(2):80–8. doi: 10.1016/j.smhs.2020.05.005
21. Cherup NP, Strand KL, Lucchi L, Wooten SV, Luca C, Signorile JF. Yoga meditation enhances proprioception and balance in individuals diagnosed with Parkinson's disease. *Percept Mot Skills.* (2021) 128(1):304–23. doi: 10.1177/0031512520945085
22. Ni M, Signorile JF, Mooney K, Balachandran A, Potiaumpai M, Luca C, et al. Comparative effect of power training and high-speed yoga on motor function in older patients with Parkinson disease. *Arch Phys Med Rehabil.* (2016) 97(3):345–54.e15. doi: 10.1016/j.apmr.2015.10.095
23. Li F, Harmer P, Fitzgerald K, Eckstrom E, Stock R, Galver J, et al. Tai chi and postural stability in patients with Parkinson's disease. *N Engl J Med.* (2012) 366(6):511–9. doi: 10.1056/NEJMoa1107911
24. Moratelli JA, Alexandre KH, Boing L, Swarowsky A, Corrêa CL, de Guimarães ACA. Dance rhythms improve motor symptoms in individuals with Parkinson's disease: a randomized clinical trial. *J Dance Med Sci.* (2022) 26(1):1–6. doi: 10.12678/1089-313X.031522a
25. Frisaldi E, Bottino P, Fabbri M, Trucco M, De Ceglia A, Esposito N, et al. Effectiveness of a dance-physiotherapy combined intervention in Parkinson's disease: a randomized controlled pilot trial. *Neurol Sci.* (2021) 42(12):5045–53. doi: 10.1007/s10072-021-05171-9
26. Lawrence M, Celestino Junior FT, Matozinho HHS, Govan L, Booth J, Beecher J. Yoga for stroke rehabilitation. *Cochrane Database Syst Rev.* (2017) 12(12):CD011483. doi: 10.1002/14651858.CD011483.pub2
27. Caron RLD, Verdun S, Triquenot-Bagan A, Tourny C, Coquart J. Yoga in the rehabilitation of post-stroke sequelae: a non-inferiority randomized controlled trial. *J Integr Complement Med.* (2024) 30(6):543–53. doi: 10.1089/jicm.2023.0315
28. Zou L, Yeung A, Li C, Chiou SY, Zeng N, Tzeng HM, et al. Effects of mind–body movements on balance function in stroke survivors: a meta-analysis of randomized controlled trials. *Int J Environ Res Public Health.* (2018) 15(6):1292. doi: 10.3390/ijerph15061292
29. Pandian JD, Verma SJ, Arora D, Sharma M, Dhaliwal R, Khatter H, et al. INSTRuCT: protocol, infrastructure, and governance. *Stroke.* (2021) 52(10):e574–80. doi: 10.1161/STROKEAHA.120.033149
30. Surya N. Rehabilitation of multiple sclerosis patients in India. *Ann Indian Acad Neurol.* (2015) 18(Suppl 1):S43–7. doi: 10.4103/0972-2327.164828

31. Mathew T, Kamath V, John SK, Netravathi M, Iyer RB, Raghavendra S, et al. A real world multi center study on efficacy and safety of natalizumab in Indian patients with multiple sclerosis. *Mult Scler Relat Disord.* (2022) 66:104059. doi: 10.1016/j.msard.2022.104059
32. Shohani M, Kazemi F, Rahmati S, Azami M. The effect of yoga on the quality of life and fatigue in patients with multiple sclerosis: a systematic review and meta-analysis of randomized clinical trials. *Complement Ther Clin Pract.* (2020) 39:101087. doi: 10.1016/j.ctcp.2020.101087
33. Lysogorskaia E, Ivanov T, Mendalieva A, Ulmasbaeva E, Youshko M, Brylev L. Yoga vs physical therapy in multiple sclerosis: results of randomized controlled trial and the training protocol. *Ann Neurosci.* (2023) 30(4):242–50. doi: 10.1177/09727531231161994
34. Baishya A, Sharma S, Hazarika D, Saini S, Sharma H, Metri K. Yoga in autoimmune disorders: a systematic review of randomized controlled trials. *Ann Behav Med.* (2025) 59(1):kaaf049. doi: 10.1093/abm/kaaf049
35. Pan Y, Huang Y, Zhang H, Tang Y, Wang C. The effects of Baduanjin and yoga exercise programs on physical and mental health in patients with multiple sclerosis: a randomized controlled trial. *Complement Ther Med.* (2022) 70:102862. doi: 10.1016/j.ctim.2022.102862
36. Telles S, Balkrishna A, Maharana K. Effect of yoga and ayurveda on Duchenne muscular dystrophy. *Indian J Palliat Care.* (2011) 17(2):169–70. doi: 10.4103/0973-1075.84544
37. Rastogi S. Rehabilitative potential of Ayurveda for neurological deficits caused by traumatic spinal cord injury. *J Ayurveda Integr Med.* (2014) 5(1):56–9. doi: 10.4103/0975-9476.128868
38. Singh SK, Rajoria K. Ayurvedic approach in the management of spinal cord injury: a case study. *Anc Sci Life.* (2015) 34(4):230–4. doi: 10.4103/0257-7941.160870
39. Sylaja PN, Nambiar V, Narayan S, Jaya PR, Kumar CS, Pravith NK, et al. Ayurvedic treatment in the rehabilitation of ischemic stroke patients in India: a randomized controlled trial (RESTORE). *Int J Stroke.* (2025) 20(10):1214–24. doi: 10.1177/17474930251349727
40. Raju PS, Verma SJ, Dhasan A, Arora D, Pandian JD, Nambiar V, et al. Ayurvedic treatment in the rehabilitation of ischemic stroke patients in India: a randomized controlled trial (RESTORE) — findings from the process evaluation. *Cerebrovasc Dis.* (2026) 55(2):211–9. doi: 10.1159/000547133
41. Yadav B, Rai A, Mundada PS, Singhal R, Rao BCS, Rana R, et al. Safety and efficacy of Ayurvedic interventions and yoga on long term effects of COVID-19: a structured summary of a study protocol for a randomized controlled trial. *Trials.* (2021) 22(1):378. doi: 10.1186/s13063-021-05326-1
42. Cilia R, Laguna J, Cassani E, Cereda E, Pozzi NG, Isaias IU, et al. *Mucuna pruriens* in Parkinson disease: a double-blind, randomized, controlled, crossover study. *Neurology.* (2017) 89(5):432–8. doi: 10.1212/WNL.0000000000004175
43. Katzenschlager R, Evans A, Manson A, Patsalos PN, Ratnaraj N, Watt H, et al. *Mucuna pruriens* in Parkinson's disease: a double blind clinical and pharmacological study. *J Neurol Neurosurg Psychiatry.* (2004) 75(12):1672–7. doi: 10.1136/jnnp.2003.028761
44. Cilia R, Laguna J, Cassani E, Cereda E, Raspini B, Barichella M, et al. Daily intake of *Mucuna pruriens* in advanced Parkinson's disease: a 16-week, noninferiority, randomized, crossover, pilot study. *Parkinsonism Relat Disord.* (2018) 49:60–6. doi: 10.1016/j.parkreldis.2018.01.014
45. Boonmongkol T, Phokaewvarangkul O, Vimolmangkang S, Wattanavijitkul T, Komenkul V, Bhidayasiri R. Comparative efficacy of *Mucuna pruriens* and conventional levodopa in Parkinson's disease: a randomized controlled trial on pharmacokinetics and clinical perspectives from Asia. *J Neural Transm (Vienna).* (2025) 132(11):1673–83. doi: 10.1007/s00702-025-02914-2
46. Caronni S, Del Sorbo F, Barichella M, Fothergill-Misbah N, Denne T, Laguna J, et al. *Mucuna pruriens* to treat Parkinson's disease in low-income countries: recommendations and practical guidelines from the farmer to clinical trials. Paving the way for future use in clinical practice. *Parkinsonism Relat Disord.* (2024) 124:106983. doi: 10.1016/j.parkreldis.2024.106983
47. Choudhary D, Bhattacharyya S, Bose S. Efficacy and safety of ashwagandha (*Withania somnifera* (L.) Dunal) root extract in improving memory and cognitive functions. *J Diet Suppl.* (2017) 14(6):599–612. doi: 10.1080/19390211.2017.1284970
48. Arumugam V, Vijayakumar V, Balakrishnan A, Bhandari RB, Boopalan D, Ponnurangam R, et al. Effects of ashwagandha (*Withania somnifera*) on stress and anxiety: a systematic review and meta-analysis. *Explore (NY).* (2024) 20(6):103062. doi: 10.1016/j.explore.2024.103062
49. Pandit S, Srivastav AK, Sur TK, Chaudhuri S, Wang Y, Biswas TK. Effects of *Withania somnifera* extract in chronically stressed adults: a randomized controlled trial. *Nutrients.* (2024) 16(9):1293. doi: 10.3390/nu16091293
50. Verma N, Gupta SK, Tiwari S, Mishra AK. Safety of ashwagandha root extract: a randomized, placebo-controlled study in healthy volunteers. *Complement Ther Med.* (2021) 57:102642. doi: 10.1016/j.ctim.2020.102642
51. Speers AB, Cabey KA, Soumyanath A, Wright KM. Effects of *Withania somnifera* (ashwagandha) on stress and the stress-related neuropsychiatric disorders anxiety, depression, and insomnia. *Curr Neuropharmacol.* (2021) 19(9):1468–95. doi: 10.2174/1570159X19666210712151556
52. Paul S, Chakraborty S, Anand U, Dey S, Nandy S, Ghorai M, et al. *Withania somnifera* (L.) Dunal (ashwagandha): a comprehensive review on ethnopharmacology, pharmacotherapeutics, biomedicinal and toxicological aspects. *Biomed Pharmacother.* (2021) 143:112175. doi: 10.1016/j.biopha.2021.112175
53. Calabrese C, Gregory WL, Leo M, Kraemer D, Bone K, Oken B. Effects of a standardized *Bacopa monnieri* extract on cognitive performance, anxiety, and depression in the elderly: a randomized, double-blind, placebo-controlled trial. *J Altern Complement Med.* (2008) 14(6):707–13. doi: 10.1089/acm.2008.0018
54. Downey LA, Kean J, Nemeh F, Lau A, Poll A, Gregory R, et al. An acute, double-blind, placebo-controlled crossover study of 320 mg and 640 mg doses of a special extract of *Bacopa monnieri* (CDRI 08) on sustained cognitive performance. *Phytother Res.* (2013) 27(9):1407–13. doi: 10.1002/ptr.4864
55. McPhee GM, Downey LA, Wesnes KA, Stough C. The neurocognitive effects of *Bacopa monnieri* and cognitive training on markers of brain microstructure in healthy older adults. *Front Aging Neurosci.* (2021) 13:638109. doi: 10.3389/fnagi.2021.638109
56. Yang A, Wu HM, Tang JL, Xu L, Yang M, Liu GJ. Acupuncture for stroke rehabilitation. *Cochrane Database Syst Rev.* (2016) 2016(8):CD004131. doi: 10.1002/14651858.CD004131.pub3
57. Zhan J, Xiong B, Zhang P, Wang Y, Tang Y, Zhan L, et al. Abdominal acupuncture as an adjunctive therapy for the recovery of motor function after stroke: a systematic review and meta-analysis of randomized controlled trials. *Front Neurol.* (2021) 12:705771. doi: 10.3389/fneur.2021.705771
58. Zhou L, Wang Y, Qiao J, Wang QM, Luo X. Acupuncture for improving cognitive impairment after stroke: a meta-analysis of randomized controlled trials. *Front Psychol.* (2020) 11:549265. doi: 10.3389/fpsyg.2020.549265
59. You YN, Song MY, Park GC, Na CS, Han JY, Cho MR, et al. Meta-analysis on randomized controlled trials for scalp acupuncture treatment of stroke: a systematic review. *J Tradit Chin Med.* (2018) 38(4):465–79.
60. Wang X, Yin L, Wang Y, Zhang H, Zhang S, Wu J, et al. Transcutaneous electrical acupoint stimulation for upper limb motor recovery after stroke: a systematic review and meta-analysis. *Front Aging Neurosci.* (2024) 16:1438994. doi: 10.3389/fnagi.2024.1438994
61. Lam Ching W, Li HJ, Guo J, Yao L, Chau J, Lo S, et al. Acupuncture for post-stroke depression: a systematic review and network meta-analysis. *BMC Psychiatry.* (2023) 23(1):314. doi: 10.1186/s12888-023-04749-1
62. World Health Organization. *International Classification of Functioning, Disability and Health (ICF)*. Geneva: World Health Organization (2001).

63. Prabhakaran D, Chandrasekaran AM, Singh K, Mohan B, Chattopadhyay K, Chadha DS, et al. Yoga-based cardiac rehabilitation after acute myocardial infarction: a randomized trial. *J Am Coll Cardiol.* (2020) 75(13):1551–61. doi: 10.1016/j.jacc.2020.01.050

64. Saper RB, Kales SN, Paquin J, Burns MJ, Eisenberg DM, Davis RB, et al. Heavy metal content of ayurvedic herbal medicine products. *JAMA*. (2004) 292(23):2868–73. doi: 10.1001/jama.292.23.2868

65. Mikulski MA, Wichman MD, Simmons DL, Pham AN, Clottey V, Fuortes LJ. Toxic metals in ayurvedic preparations from a public health lead poisoning cluster investigation. *Int J Occup Environ Health.* (2018) 23(3):187–92. doi: 10.1080/10773525.2018.1447880

66. Kumar R, Arora R, Sarangi SC, Ganeshan NS, Agarwal A, Kaleekal T, et al. Pharmacodynamic and pharmacokinetic interactions of hydroalcoholic leaf extract of *Centella asiatica* with valproate and phenytoin in experimental models of epilepsy in rats. *J Ethnopharmacol.* (2021) 270:113784. doi: 10.1016/j.jep.2021.113784

67. World Health Organization. *Intersectoral Global Action Plan on Epilepsy and Other Neurological Disorders 2022–2031*. Geneva: World Health Organization (2022).

68. Amatya B, Khan F, Rathore FA, Nilsson M, Chen WS, Mukaino M, et al. Advancing physical and rehabilitation medicine education and research in the Asia-Oceania region: a position statement for establishing the Asia-Oceania Academic Network of Physical and Rehabilitation Medicine. *Am J Phys Med Rehabil.* (2026) 105(3):260–6. doi: 10.1097/PHM.0000000000002925

69. Srivastava A, Swaminathan A, Chockalingam M, Srinivasan MK, Surya N, Ray P, et al. Tele-neurorehabilitation during the COVID-19 pandemic: implications for practice in low- and middle-income countries. *Front Neurol.* (2021) 12:667925. doi: 10.3389/fneur.2021.667925

70. Chockalingam M, Srivastava A, Gandhi DB, Solomon JM, Kamalakannan S, Rajeswaran J, et al. Digitalization of neurorehabilitation in LMICs: experiences from the Indian Federation of Neurorehabilitation. *Neurol India.* (2023) 71(4):783–4. doi: 10.4103/0028-3886.383873