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Spirituality: an essential element for positive ageing

Nilamadhab Kar

Abstract

Spirituality is a multidimensional concept with various facets which primarily include a greater understanding of self in the context of being a part of the whole. Although usually studied or considered along with religion or faith, spirituality is distinct from religiousness. It is relevant in mental health and positive ageing for various reasons. Spirituality brings meaning and understanding to many inherent parts of the ageing process. It can help cope with negative life experiences, deal with challenges, and support a sense of belonging, self-contentment, and understanding the meaning of life. It has been blended into various psychotherapeutic interventions, with positive outcomes. Spirituality also improves the quality of life of older adults. Caregivers need to be aware of the spiritual needs of older adults and support them in achieving those during everyday interactions. Integration of spirituality into old age care is essential.

Keywords

Ageing, Mental health, Psychotherapy, Quality of Life, Spirituality

Introduction

Spirituality is a broad concept; however, it has many core universal essences. It is an understanding of the self being a part of the whole, a search for meaning and purpose in life. Spirituality is entwined with religion or faith;¹ and often they are studied together, although they are different as people can be spiritual without being religious. It is a complex, multidimensional construct involving various facets. It has a varied meaning for different people. Spirituality is often linked to qualities such as love, compassion, wisdom, patience, tolerance, a sense of detachment, and hope. It is evident from the qualities of spirituality that it is so connected to mental health. At the same time in various ways, it is also relevant for physical health, chronic illnesses, suffering, and end-of-life issues. In frail older adults, spirituality is a known contributor to psychological well-being.² Interestingly a connection between spirituality and longevity has been suggested.

Spirituality has several roles in the everyday lives of older adults. It hones the capacity to bear the limitations, difficulties, and losses inherent to the ageing, and facilitates acceptance. It is reported to be a source of strength, comfort, and hope, and brings about a sense of

community and belonging;³ self-contentment, and clarifies the meaning of life.^{4,5} It also contributes to positive late-life functioning and promotes healthy ageing.

Mental health

There are observations that spirituality has a positive impact on the mental health of older people.⁶ People feel a higher sense of purpose, peace, hope, and meaning; they may experience better confidence, self-esteem, and self-control. It may help to make sense of the experiences in life. When unwell, spirituality may help individuals to resort to their inner strength and recover faster. At the least, spirituality may help to have better relationships with others.

In the process of understanding the influence of spirituality on mental health, it is often needed to unravel the religious beliefs and experiences of the individual. It has been observed that older adults who have high religious and spiritual levels have greater life satisfaction and psychological well-being, better social relations, and more definite meaning in life along with lower levels of anxiety and depression.⁷ Spirituality evaluations can be a routine part of the assessment of older adults in various adverse situations and clinical examination, which can provide a better and complete understanding of their life and wellbeing. This can help caregivers to provide higher standards of holistic person-centered care.

Spiritual health

Individuals can improve their spiritual health by various means, e.g. understanding what makes one peaceful, loved, and connected; sharing time for community services, helping others, being generous, meditating, and practicing yoga are helpful. Similarly, mindfulness, having time for one's own self, being and living in the present rather than dwelling in the past or worrying about the future, supports individuals achieving their spiritual self. As spirituality is being understood through its various facets, it is important for people to learn and explore, sometimes independently, to find reliable sources and information. More importantly, it is better to realise what it means for one's own self, and how one can practice and lead a life of spirituality.

Spirituality as a therapeutic intervention

Spirituality has been used in therapeutic interventions for mental illnesses. Supporting older adults spiritually helps

them to have positive emotions and to cope with stress.⁴ It is observed that older adults prefer the inclusion of religious/ spirituality in their therapies for anxiety and depression.⁸ Integrating spirituality into usual caregiving may improve the caregiver and older adult relationships. Spiritual care can be facilitated by supporting patients to connect, complete unfinished business, respecting and providing them with privacy and personal time, comforting and reassuring, supporting them to conduct their religious practices (prayers), etc.

Spirituality has been blended into existing psychotherapies. For example, a psychotherapeutic method has been developed which is Spiritually Augmented Cognitive Behaviour Therapy, providing whole-person care and achieving better global outcomes.⁹ This technique incorporates spiritual values into cognitive behaviour therapy and emphasizes acceptance, hope, achieving meaning and purpose, and forgiveness. The spiritual concepts have also been incorporated into the treatment programmes of substance use disorders.

In essence, the spiritual qualities may help individuals to cope better,⁴ have more resilience, and contribute productively to their society, which is suggestive of a better mental state. This might also suggest a better prognosis while recovering from mental illnesses. Thus, it is essential to assess and give importance to the spiritual values of the individual patients.

Quality of life

While the effects of age and chronic diseases are non-modifiable variables for the quality of life of older adults, spirituality has been observed as a modifiable variable.¹⁰ This can be supported for a positive outcome of various mental and physical illnesses, and as a consequence, these can improve quality of life. Older adults living in miserable conditions, in insufficiently supportive environments, with loneliness, frailty, and helplessness, require support to improve their spiritual health.

Conclusion

Spirituality has a positive value for older adults, supporting them in various ways for a healthy ageing and maintaining resilience in the context of age-related consequences of life. Individual approaches towards spirituality should be explored and supported. Family members, caregivers, and clinicians should remain aware of this and may get trained, to increase their skills in applying or blending this approach in the day-to-day care of older adults. Further research is needed to understand the effect of spirituality in psycho-sociocultural aspects of ageing and clinical outcomes in old age-related illnesses.

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Case Report

Delayed toxic-hypoxic leukoencephalopathy following oxycodone overdose: a case report

Ann Maria Varghese, Stephanus Schutte, Jayashree Viswanathan

Abstract

We present the case of a 63-year-old female who developed delayed cognitive and behavioural deterioration secondary to suspected toxic-hypoxic leukoencephalopathy following an intentional oxycodone overdose. Initial neuroimaging was nonspecific, but subsequent evaluations revealed a subacute infarct and diffuse white matter changes. Comprehensive investigations excluded other potential causes, and her condition gradually improved with supportive management and neuro rehabilitation. This case underscores the need to consider delayed toxic hypoxic leukoencephalopathy as a differential diagnosis in patients who develop progressive neuropsychiatric symptoms following an opioid overdose.

Keywords

Drug Overdose, Hypoxia, Leukoencephalopathy, Neuropsychiatry, Oxycodone, White Matter

Introduction

Delayed toxic-hypoxic leukoencephalopathy (DTHL) is a rare neurological syndrome characterized by delayed neuropsychiatric deterioration following an initial recovery from a hypoxic or toxic event. Common triggers include opioid overdose, carbon monoxide exposure, and other neurotoxic substances.^{1,2} The condition is typically characterized by a biphasic clinical course: an initial recovery phase followed by a subacute onset of cognitive impairment, behavioural changes, and motor dysfunction, which occurs days to weeks later.³ Magnetic resonance imaging (MRI) typically reveals widespread white matter hyperintensities, with sparing of the cortex, in the early stages, and is the key diagnostic tool for identifying the condition. The pathophysiology is believed to involve delayed demyelination resulting from oligodendrocyte damage and secondary disruption of the blood-brain barrier.^{4,5} Diagnosis is often challenging due to the nonspecific symptoms and the delayed nature of presentation. A thorough exclusion of mimics such as stroke, autoimmune encephalitis, paraneoplastic syndromes, and hereditary leukodystrophies is necessary.⁶ The prognosis of delayed toxic hypoxic leukoencephalopathy (DTHL) varies, with some patients experiencing full recovery while others may have persistent neurological deficits or even death.⁷

This report describes a case of a 63-year-old female who developed delayed neurocognitive decline and behavioural disturbances nearly four weeks after an intentional oxycodone overdose. It highlights the clinical course, diagnostic process, and recovery support necessary in the treatment of a patient with medical and psychiatric comorbidities and diagnosis of DTHL.

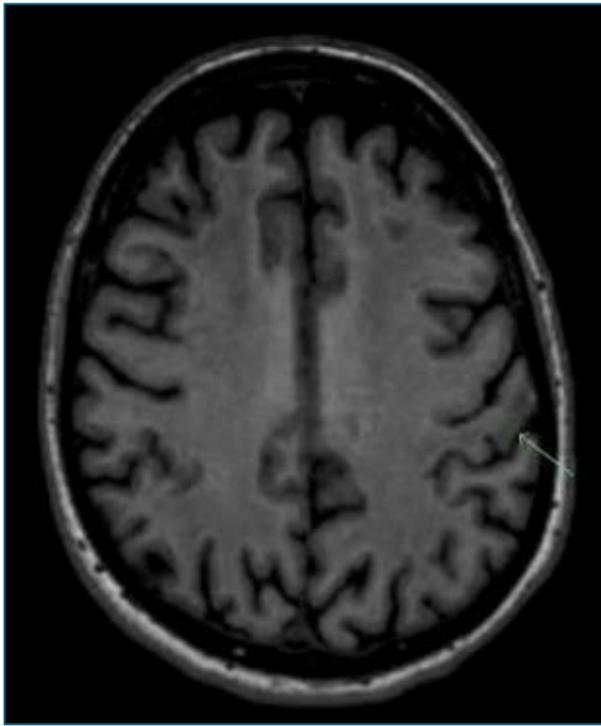
Case Presentation

A 63-year-old Caucasian female with a history of depression and anxiety disorder, known to the adult community mental health team and diagnosed with Hashimoto's thyroiditis and diverticular disease was brought to the emergency department by paramedics following a suspected intentional overdose of an unknown medication in an undetermined quantity. On initial assessment by paramedics, she presented with a Glasgow Coma Scale (GCS) score of 4 (E1V2M1), non-reactive pinpoint pupils, and shallow respirations (respiratory rate: 8 breaths per minute). She was bradycardic (heart rate: 45 bpm), hypotensive (BP: 78/52 mmHg), hypoxic (SpO₂: 79%), and hypothermic (temperature: 34.8°C). During pre-hospital care, she received intravenous fluids, high-flow oxygen at 15 L/min, and three doses of naloxone (400 mcg each).

Upon arrival to the emergency department (ED), her GCS had improved to 8, and she was able to maintain her airway; however, she remained bradycardic (heart rate: 37 bpm), hypoxic (SpO₂: 90% on 2 L O₂), and hypotensive (SBP: 70 mmHg), necessitating intravenous fluids, atropine, and a metaraminol infusion.

During further evaluation in the ED, she was noted to have right-sided hemiparesis, prompting urgent Computed Tomography (CT) brain and CT angiogram of the Circle of Willis and neck vessels and review by the stroke team. Neuroimaging revealed no evidence of an intracranial haemorrhage or central thrombotic arterial occlusion of the major branches of the Circle of Willis. The intensive care team was consulted and recommended a trial of naloxone infusion. Following administration, her GCS improved to 14, and upon regaining full consciousness, she disclosed ingesting an unknown quantity of oxycodone with suicidal intent. A continuous naloxone infusion was initiated at 400 mcg/hour.

Figure 1: T1 weighted axial MRI suggestive of hypointensity in the left parietal region consistent with an infarct.

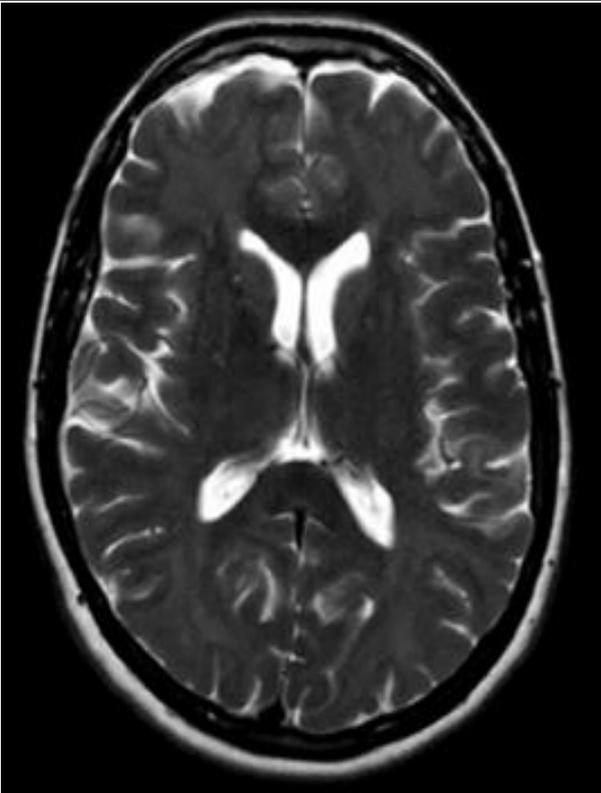


The patient was enrolled in the medical ward for further inpatient management and monitoring of their condition. During her inpatient stay, she was referred to the Consultation-Liaison Psychiatry team for mental health evaluation. Once medically stabilized, she was transferred to the mental health unit for further psychiatric assessment and care.

She initially settled well into the ward environment and was regularly reviewed by the treating psychiatrist. During these reviews, she reported escalating anxiety symptoms, which were attributed to multiple ongoing psychosocial stressors. Her psychotropic regimen was subsequently optimized with sertraline, mirtazapine, and initiating risperidone. She also received input from clinical psychology and occupational therapy teams during her inpatient stay. In the early phase of admission, she was oriented, displayed mostly a euthymic affect but occasionally anxious, actively engaged with peers, and participated fully in structured ward-based activities such as art, yoga, and hydrotherapy. She remained independent in all activities of daily living.

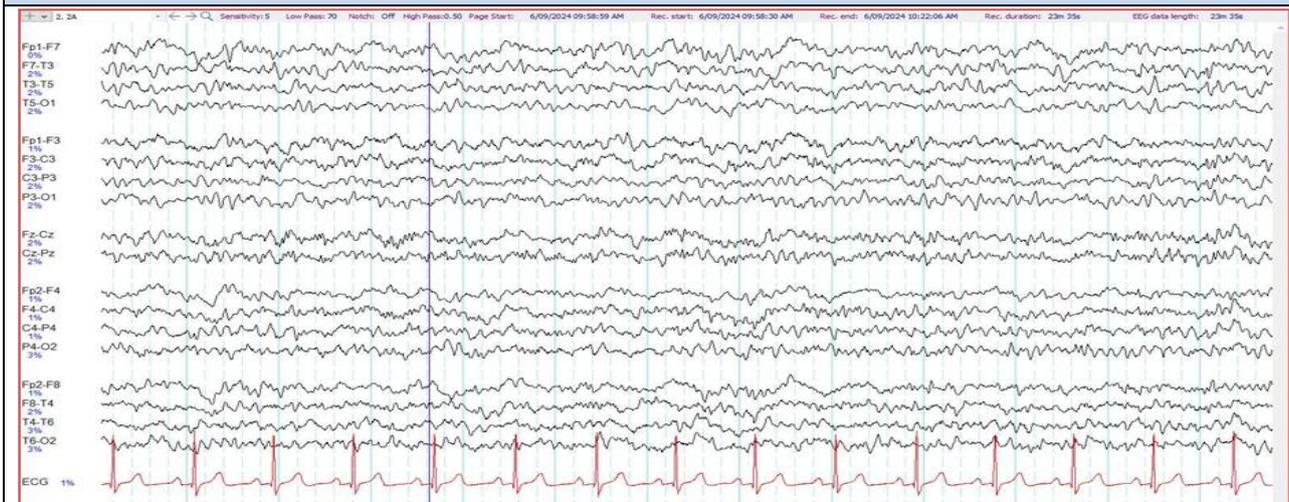
However, on day 26 following the overdose, she experienced an acute behavioural shift marked by cognitive and functional decline. She became vague and confused, with fluctuating awareness of time, place, and person. She was noted to be inattentive and apathetic along with diminished spontaneous movements, limited verbal responsiveness, and significantly reduced interaction with staff, peers, and family members. She started requiring full assistance with activities of daily living, including showering and dressing.

Figure 2: T2-weighted axial MRI image showing diffuse periventricular and deep white matter hyperintensities suggestive of leukoencephalopathy.



The initial brain MRI revealed symmetric supratentorial parenchymal signal changes, which were nonspecific and indeterminate for leukoencephalopathy. A neurology consultation was obtained, and a clinical examination revealed no focal neurological deficits. A repeat contrast-enhanced MRI of the brain demonstrated cortical and gyri form enhancement in the left postcentral gyrus, consistent with a subacute infarct and a breakdown in the blood-brain barrier (Fig 1 and 2). A late subacute infarct was shown in the left temporal lobe. There was no change in the asymmetric diffuse hyperintensities in the cerebral white matter, suggestive of leukoencephalopathy. The patient's clinical presentation and neuroimaging findings were reviewed at the multidisciplinary team meeting in neuroradiology. It was concluded that the observed changes in imaging were consistent with a maturing infarct. A retrospective review of the CT brain angiogram obtained at the time of admission revealed features suggestive of a likely left parietal stroke. The infarct was considered the likely cause of the patient's acute neurological deterioration with delayed onset following the opioid overdose. At the time, the aetiology of the diffuse white matter hyperintensities remained unclear.

Electroencephalography (EEG) showed mild generalized slowing, indicative of a nonspecific diffuse disturbance in cerebral function consistent with encephalopathy, with no evidence of epileptiform activity (Fig 3 and 4).

Figure 3: EEG recorded during awake state

Mild generalised slowing keeping with non-specific diffuse disturbance of cerebral function as seen in encephalopathy.

Figure 4. EEG during photic stimulation

Persistent generalised slowing despite eye opening and eye closure, suggesting underlying diffuse cerebral dysfunction even in alert state.

Over the course of her inpatient stay, the patient developed progressive gait instability, impaired coordination, and urinary incontinence. Her apathy and psychomotor slowing advanced to a state of abulia. Meanwhile, her mental state remained stable, with no evidence of depressive symptoms or anxiety.

Comprehensive blood investigations were unremarkable. Toxicology screening was negative. Autoimmune markers, including rheumatoid factor, C3/C4 complement levels, cryoglobulins, erythrocyte sedimentation rate (ESR), rapid plasma reagin (RPR), and antinuclear antibodies (ANA), were all within normal limits (Table 1). Cerebrospinal fluid (CSF) analysis revealed normal protein levels and leukocyte counts. CSF cytology, as well as testing for serum and CSF oligoclonal bands, N-methyl-D-aspartate (NMDA) receptor antibodies, voltage-gated potassium channel (VGKC) antibodies, and alpha-

amino-3-hydroxy-5-methyl-4-isoxazolepropionic acid (AMPA) receptor antibodies, returned negative results. Paraneoplastic antibody screening in serum was also negative. Genetic testing for leukodystrophies revealed no abnormalities. Finally, a CT scan of the chest, abdomen, and pelvis excluded the presence of any occult malignancy.

Around three weeks following the onset of behavioural and neurological decline, the patient began to exhibit gradual improvement in cognitive function and engagement. A repeat brain MRI showed no significant change in the leukoencephalopathy and persistent findings related to the prior infarcts. To further evaluate the cerebral white matter abnormalities, an MRI of the spinal cord was done and reported as normal. A follow-up EEG also demonstrated normal findings.

Table 1: Lab investigation results	
Tests	Results
Serum NMDA receptor antibodies	Not detected
Serum VGKC antibodies	Not detected
Serum paraneoplastic antibodies	Not detected
Extractable nuclear antigens	Negative
Serum trace metals	Negative
ANCA	Negative
Syphilis, hepatitis, and HIV serology	Negative
Urine bile acid screen	Negative
Leukodystrophy gene panel	Negative
Antinuclear antibodies	80 (<160)
Serum complement C3	1.31g/L (0.90-1.70)
Serum complement C4	0.30 g/L(0.10-1.40)
Rheumatoid factor	<14IU/ml
CCP antibodies	<5 U/ml
CSF analysis	
CSF protein	0.60g/l (0.15-0.45)
CSF glucose	3.5mmol/l (2.8-4.2)
CSF cytology	No malignant cells
CSF culture	No aerobic or anaerobic growth
CSF VGKC antibodies	Not detected
CSF oligo clonal bands	Negative
CSF NMDA receptor antibodies	Not detected
CSF AMPA receptor antibodies	Not detected
CSF encephalitis and meningitis screen	Negative
AMPA: alpha-amino-3-hydroxy-5-methyl-4-isoxazolepropionic acid, ANCA: Antineutrophil cytoplasmic antibodies, CCP: cyclic citrullinated peptide, CSF: Cerebrospinal fluid, HIV: Human Immunodeficiency Virus, NMDA: N-methyl-D-aspartate, VGKC: Voltage-gated K channel	

A neuropsychological assessment was conducted. Mood symptoms were screened using the 21-item Depression, Anxiety, and Stress Scale (DASS-21),⁸ which yielded results within normal limits. To assess behavioural changes associated with potential frontal lobe dysfunction, the Frontal Systems Behaviour Scale (FrSBe)⁹ was administered. The patient demonstrated significant difficulty completing the self-report component, and ratings provided by a collateral informant revealed clinically significant abnormalities across all three domains: apathy, disinhibition, and executive dysfunction. Cognitive testing indicated performance below premorbid expectations across multiple domains. Specific deficits—classified as 'below average' or lower—were observed in attention, learning, memory, working memory, processing speed, executive function, and visuospatial construction. These impairments were found to interfere with instrumental activities of daily living. The overall profile was consistent with a diagnosis of

mild neurocognitive disorder due to multiple aetiologies with behavioural disturbance, by criteria outlined in the Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition (DSM-5).¹⁰

Following comprehensive neurological evaluations and diagnostic investigations, subacute leukoencephalopathy, likely delayed toxic hypoxic leukoencephalopathy, was identified as the most likely cause of the patient's acute cognitive and behavioural deterioration. The neurology team initiated aspirin 100 mg once daily. Supportive care measures were also provided, including physiotherapy, adequate hydration, and neurocognitive monitoring. Corticosteroids and immunomodulatory therapies were not administered.

The patient demonstrated gradual clinical improvement, with resolution of motor symptoms and regained orientation. She was able to resume performing activities of daily living independently. While cognitive function did not return to premorbid levels, partial improvement was noted. As there were no clinical signs suggestive of anxiety or depression, psychotropic medications were tapered accordingly.

A multidisciplinary discharge planning meeting was conducted involving the treating team, neurology, allied health professionals, and the patient's family. It was recommended that she undergo a neurology outpatient follow-up in six months, with a repeat brain MRI to assess progress. Post-discharge, she was referred to the adult community mental health team for continued monitoring of her mental state. She was also enrolled in the Rehab in the Home (RITH) program, with occupational therapy sessions scheduled twice weekly for 12–16 weeks to support ongoing cognitive rehabilitation in her home environment. A referral was initiated to Neurocare to offer carer support and promote engagement with outpatient services. A plan was established to closely monitor her cognitive function and explore an application to the National Disability Insurance Scheme (NDIS)¹¹ for further support services.

Discussion

This case demonstrates the classic biphasic course of DTHL, beginning with a life-threatening opioid overdose followed by a delayed onset of cognitive and behavioural decline. The patient's initial improvement post-overdose and subsequent abrupt deterioration on day 26 are characteristic of this syndrome.^{2,3}

MRI findings in this case, namely, diffuse white matter hyperintensities and delayed cortical/gyriform enhancement are consistent with reported imaging patterns in DTHL and suggest a combined effect of hypoxic injury and infarction.^{4,12} Although her early brain imaging was inconclusive, repeat imaging combined with clinical deterioration and EEG changes ultimately supported the diagnosis. Retrospective CT angiogram review also indicated a likely infarct, adding complexity to the clinical picture.

Neuropsychological assessment revealed impairments in multiple cognitive domains, including executive function, memory, attention, and visuospatial skills, - findings which are frequently seen in toxic or hypoxic leukoencephalopathy.¹³ The use of the Frontal Systems Behaviour Scale (FrSBe),⁹ and DASS-21,⁸ helped to characterize her behavioural profile and distinguish neuropsychiatric features from mood symptoms. Notably, her cognitive profile met DSM-5 criteria for mild neurocognitive disorder due to multiple aetiologies.¹⁰

The management of DTHL remains largely supportive. Corticosteroids and immunotherapy have been explored in isolated cases but with limited supporting evidence.¹⁴ In this patient, the use of aspirin, neurorehabilitation, and structured follow-up allowed for partial recovery of motor function and improvement in orientation and daily functioning. However, persistent cognitive deficits highlight the often incomplete recovery associated with DTHL, particularly in older patients.¹⁵ The prognosis of DTHL is highly variable and depends on several factors including duration of hypoxic insult, extent of white matter involvement, and timeliness of supportive care. While some patients recover fully over weeks to months, others experience persistent neurocognitive deficits, psychiatric symptoms, or motor impairments.¹⁶

This case emphasizes the significance of a multidisciplinary approach that includes neurology, psychiatry, allied health professionals, and family support. A key aspect of her ongoing care involved integrating cognitive rehabilitation with discharge planning, which included utilizing community mental health services and occupational therapy.

Conclusion

The DTHL is an infrequent but clinically important neurological condition that warrants consideration in patients presenting with subacute cognitive and behavioural deterioration following a temporary recovery from hypoxic or toxic insult. Timely diagnosis supported by neuroimaging, systematic exclusion of differential diagnoses, and integrated multidisciplinary care are key to improving clinical outcomes. Although full neurological recovery may not always be attainable, early targeted rehabilitation and engagement with community services can lead to meaningful enhancements in functional capacity and quality of life.

Ethical considerations

Written informed consent was obtained from the patient for the publication of this case report and any associated images.

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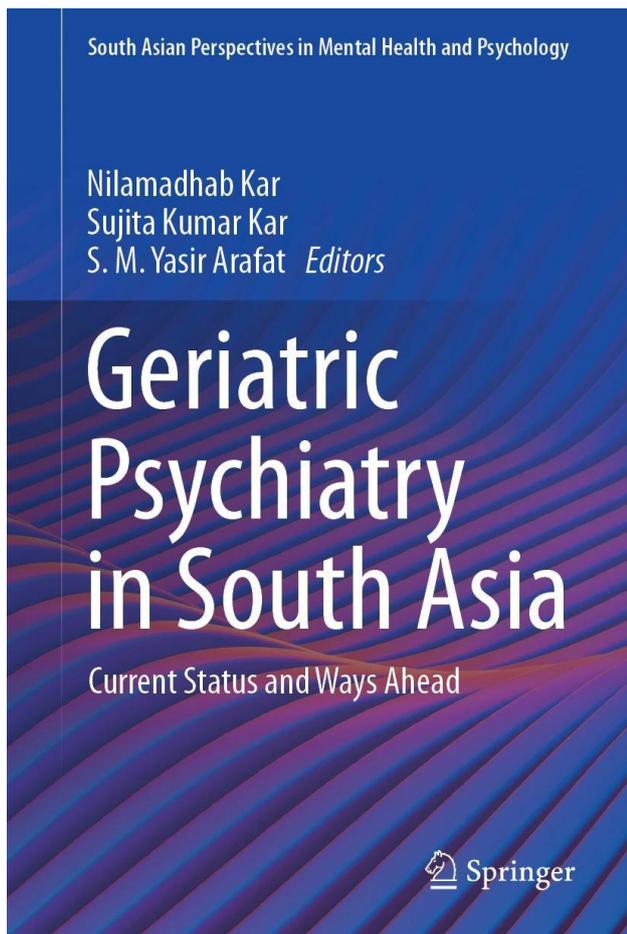
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Book Review

'Geriatric Psychiatry in South Asia: Current Status and Ways Ahead' – A timely resource book

Susmit Roy



The book "Geriatric Psychiatry in South Asia: Current Status and Ways Ahead," published by Springer Nature,¹ takes the initiative of looking at the growing old age-related mental health concerns in the South Asian countries. This will be useful in the context that the population of older adults in these countries is growing exponentially; and understanding their mental health concerns and management approaches will help the clinicians and authorities to prepare well for developing the services.

This book will increase the awareness about the growing needs of old age care, especially in these regions where there are scant services, resources, and a smaller number of trained professionals.² Another worrying concern is that these countries experience economic migration, so that the younger generation is moving away to different

places or countries for work, leaving older adults behind. So the number of older people living alone and in old-age homes is increasing. Stress, isolation, anxiety, and depression are on the rise. Old age mental health concerns are going to rise and this book would be timely to improve the knowledgebase in the area.

There is inadequate research about the mental health burden, psychosocial concerns, and any interventions. There are many other worrying concerns, such as financial struggles for health-related expenses, lack of caregivers, and elder abuse. This book highlights the support, policies, programmes, and laws available in these countries and what is needed.

The book covers various areas of the current status of old age psychiatry in South Asian countries in its 12 chapters.³⁻¹⁴ There are country-specific chapters that highlight the specific issues relevant to the countries.^{3,6,7,10,13,14} All these countries are developing economies at various levels, and the range of services varies considerably. It is insightful to see how the services are at the moment, the future needs in these countries and how these can be managed.

There are chapters covering specific topics such as disease burden and services gap,⁹ social determinants and cultural aspects,⁸ old age related public mental health,¹² prevention,⁴ substance use,¹¹ and existing policies, programs and laws,⁵ in these countries. While the book highlights the current state of affairs in old age mental health care, it also emphasizes the importance of preventing psychiatric illnesses through various strategies. The chapters give ideas about what can be done at clinic, community, state, and country level, and how regional cooperation among South Asian countries would be helpful.

This book covers relevant areas and is highly comprehensive. It will be helpful not only to mental health professionals in old age psychiatry, but also to professionals working with older adults, geriatric medicine, nurses, social workers, occupational therapists, counsellors and psychologists, planners and policy makers, and the health authorities looking after and developing services for the older adults. This will be a useful resource for non-governmental organisations working in the field of old age care, the medical centres, and training institutes.

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Review

Role of biomarkers in sepsis: a narrative review

Sneha Kar

Abstract

Sepsis is a life-threatening condition that leads to severe organ failure. It is a growing major concern, disproportionately affecting older adults, who represent 60 to 80% of the cases. Despite improvements in treatment over the years, mortality rates remain around 20%. Many patients require treatment in the intensive care unit for sepsis. There are many causes of this, ranging from bacteria to viruses. It is important to diagnose sepsis early, so effective treatment can be instituted early, increasing the chance for better outcomes. Treatment and diagnosis can be expedited using specific biomarkers such as C-reactive protein, procalcitonin test, and damage-associated molecular patterns. Exploring biomarkers might help the process of sepsis management.

Keywords

Biomarkers, C-reactive protein, Pathogen-Associated Molecular Pattern Molecules, Procalcitonin, Sepsis,

Introduction

Sepsis is a systemic inflammatory condition that causes life-threatening organ failure, which occurs when the body has an extreme response to an infection.¹ Sepsis is a serious clinical concern; if left untreated, it may progress rapidly, leading to septic shock, which causes organ failure, possibly leading to death.² Early recognition and diagnosis are crucial for improving the likelihood of survival. On average, the mortality rate is around 20% with around 360 cases per 100,000 people per year in the UK.³

Causes

Usually, bacterial infections are the primary cause of sepsis; however, viral and fungal infections can also lead to sepsis.³ An investigation conducted in over 70 countries discovered that in patients in ICUs, the types of infections were as follows: gram-negative(62%), gram-negative bacteria(47%), fungal (19%), and viruses having the lowest proportion.⁴ There can also be non-infectious causes of sepsis, which include sterile inflammatory conditions such as burns, pancreatitis, etc.⁵

Risk factors

Anyone can develop sepsis if infected.⁶ However, young children, older adults, and persons with underlying health

conditions, such as diabetes, have a higher risk of developing sepsis.⁷ Reports suggest that 60% to 80% of septic cases occur in people over 65.^{8,9} Older individuals are more vulnerable to developing sepsis due to frailty and a weakened immune system, and these may have serious health outcomes.¹⁰ The risks of sepsis in infants are due to malnutrition and hospital-acquired infections.¹¹

Symptoms

Symptoms of sepsis include rapid heart rate, low blood pressure, fever, and difficulty breathing.⁶ Sepsis may have Postural Orthostatic Tachycardia Syndrome (POTS) and Orthostatic Hypotension.¹² Tests are done to establish the cause of sepsis, which include blood and urine culture, etc.¹³

Management

Management of sepsis requires admission to the hospital, preferably in the intensive care unit. Treatment with appropriate antibiotics is needed. The choice of antibiotics depends on the cause of the infection and other factors such as allergies, the patient's age, etc.¹

Challenges in diagnosing sepsis

Given the variety of symptoms sepsis has, there may be overlaps with other systemic infections.¹⁴ For example, meningitis and sepsis both have dizziness, confusion, and difficulty breathing as symptoms.^{15,16} However, expected symptoms may not always be present. For example, an immunosuppressed patient may not develop a fever, or critically ill patients may experience tachycardia, but this is due to stress and is not an indication of sepsis.¹⁷

Despite the many biomarkers sepsis has, e.g., C-reactive protein (CRP) and procalcitonin (PCT), diagnosis is not based on only one of them.¹⁸ CRP is one of the most common biomarkers of sepsis, increasing in all inflammatory disorders, even in uncomplicated surgeries. PCT is also involved, though it is considered to be more specific than CRP.¹⁷

There is no single definitive test for diagnosing sepsis.¹⁹ To help categorise patients, clinicians use the Sequential Organ Failure Assessment score (SOFA) to help identify the risk of mortality of a patient or groups of patients.^{20,21} The SOFA score is based on 6 factors; these include respiratory, cardiovascular, hepatic, coagulation, renal, and neurological systems. These are scored from 0 to 4,

and the higher the score, the more likely that there is organ failure.²⁰ The SOFA score can be used daily to monitor the patient's health, as a comparative factor, and overall to see if there is any progress.²¹ However, the SOFA score cannot predict the outcome, specifically whether a patient will die or not, which depends on the care given; the SOFA score was designed for adults and is not available for children.²¹

Role of biomarkers in diagnosis, management, and prognosis of sepsis

Biomarkers play a crucial role in the diagnosis and treatment of sepsis as they further help antibiotic therapy, identify risks, and patient management.^{22,23} Many biomarkers have been identified for sepsis, including fluid phase pattern recognition molecules (PRMs), damage-associated molecular patterns (DAMPs), C-reactive protein (CRP), and lactate, being the most commonly used biomarker.^{18,22}

CRP is an acute reactive protein that is produced by the liver; it rises rapidly in response to inflammation and infection.²⁴ However, it is also affected by other factors such as trauma and surgery.²⁴ Due to this, it cannot be used alone to diagnose sepsis and should be combined with other biomarkers such as the procalcitonin test (PCT). Procalcitonin is the peptide precursor of calcitonin, and it helps maintain calcium levels in the blood.²⁵ During a bacterial infection, the immune system activates macrophages and monocytes. This activation leads to the release of pro-inflammatory cytokines, including interleukin-1 (IL-1), interleukin-6 (IL-6), and tumour necrosis factor-alpha (TNF- α). These cytokines stimulate the production of procalcitonin (PCT) in the liver and various other tissues.²⁶ PCT concentrations increase early and normalise rapidly, with a half-life of 24 hours, compared to CRP, which takes 12 to 24 hours to rise and remains raised for 3 to 7 days.²⁷ PCT levels remain low or only slightly elevated in viral or mild bacterial infections.

Due to this, PCT can contribute to an early diagnosis, lowering the chance of developing sepsis.²⁷ Furthermore, during a bacterial infection, the PCT concentration is usually above 0.1 ng/mL, but at a concentration above 0.5ng/mL, the patient may be at risk of developing sepsis.²⁷ Measuring PCT levels in urine can be valuable in patients with sepsis, particularly in cases involving urinary tract infections or urosepsis. Additionally, cerebrospinal fluid (CSF) PCT levels may help in diagnosing central nervous system infections, such as bacterial meningitis, in septic patients.^{23,28} Together, CRP and PCT values can provide a diagnosis of an infection before it develops into sepsis, making them promising biomarkers that may contribute to more effective treatment.^{27,29}

Sepsis damages various cells, including lymphocytes and gastrointestinal epithelial cells, leading to apoptotic cell death.^{7,30} When cells get destroyed, High-MobilityGroupBox1 (HMGB1), a non-histone nuclear protein involved in the regulation of inflammatory

responses, is released either actively by stimulated macrophages or passively during cellular necrosis and apoptosis. As a late mediator of sepsis, HMGB1 acts as DAMPs, which are released into the systemic circulation, and can help to promote immune defence.^{7,31} DAMPs sustain inflammation by activating macrophages through the Toll-like receptor 4 (TLR4) and receptor for advanced glycation end products (RAGE) pathways.³² Many types of DAMPs help with this, such as S100 proteins and HMGB nuclear proteins; S100 proteins are calcium-binding proteins primarily found in phagocytes' cytoplasm. S100A8/A9 are the S100 family heterodimer, and their levels become high during sepsis.⁷

Increased HMGB1 levels in the later stages of sepsis are associated with worse outcomes, particularly in patients with pre-existing chronic inflammatory conditions, and are linked to higher mortality rates.³³ Due to its role in the progression of sepsis, HMGB1 is being investigated as a potential biomarker for both diagnosis and prognosis.

While DAMPs are endogenous molecules released by dying host cells, pathogen-associated molecular pattern molecules (PAMPs) are exogenous microbial products released by pathogens; they both can increase inflammatory responses by activating signalling pathways through Pattern Recognition Pathways (PRR).^{34,35} Examples of PAMPs include lipopolysaccharide (LPS) and lipoproteins.⁷ LPS are found in large quantities in the outer membrane of gram-negative bacteria, and when found in the blood, they may lead to septic shock in large amounts. To overcome this, clinicians have attempted to block LPS associated with gram-negative infections; however, no success was achieved.⁷ One study attempted to use the E5 monoclonal antibody against LPS, administering 2 doses of E5 to 847 patients for 30 days. However, there was no significant improvement.³⁶

Overall, DAMPs can be classed as an advantage and a disadvantage due to their 'pro-inflammatory and immunosuppressive role'.³⁷ This depends on factors such as their concentration and length of exposure – if the concentration of DAMPs is too high, it may lead to a cytokine storm and cell death.^{37,38} Additionally, there is a risk of DAMPs activating Systemic Inflammatory Response Syndrome (SIRS), which in severe circumstances, leads to multi-organ failure.³⁵ PAMPs can help activate antigen-presenting cells by interacting with PRRs, which can contribute to the adaptive immune system.³⁹

Using multiple biomarkers

It is important to investigate multiple biomarkers in sepsis diagnosis and management for the enhanced accuracy of the approach in detecting and evaluating the condition. Since sepsis involves complex and varied pathophysiological processes, relying on a single biomarker may fall short of capturing the full clinical picture. Combining multiple biomarkers that reflect different dimensions of immune response, inflammation, and organ dysfunction would offer a more comprehensive assessment of the clinical status. Employing a multi-

biomarker approach facilitates early sepsis detection and helps stratify patients according to their risk of progression to severe sepsis or septic shock, ultimately guiding more precise and timely treatment decisions.

Conclusion

In summary, sepsis is a serious medical condition that requires treatment in a hospital and has a risk of death in almost 20%. Symptoms include dizziness, confusion, and breathing difficulties. Older adults are more vulnerable to sepsis and may have a worse prognosis. There are biomarkers that can help to diagnose the condition early. There are many biomarkers that can be used for investigation; the common ones are DAMPs and PAMPs. Use of multiple biomarkers is preferred. There is a need for investigating biomarkers early in patients showing the signs and symptoms of sepsis, which would help in the treatment process.

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Research

Rural-urban disparities in fear of falling among community-dwelling Indian older adults: a cross-sectional study

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Abstract

Background: Fear of falling (FOF) is a prevalent yet understudied issue among community-dwelling Indian older adults, contributing to increased fall risk and functional decline. The aim of this study was to assess FOF among elders from rural and urban areas of India and to explore the distinctive challenges and factors influencing the perception of FOF. **Methods:** In this prospective cross-sectional study, 220 community-dwelling Indian older adults participated, representing both rural and urban areas. The score of the Fall Efficacy Scale (FES-I) & its association with age and gender were also explored in both the contexts. **Results:** Rural participants had significantly higher FES-I scores compared to urban participants (34.13 ± 10.97 vs 19.58 ± 4.07), indicating a greater fear of falling ($p < 0.001$). Females reported higher FES-I scores than males (28.51 ± 11.38 vs. 25.20 ± 0.42 ; $p < 0.05$). Age also showed a significant positive correlation with FES-I scores ($r = 0.185$, $p < 0.01$). **Conclusion:** The Study highlighted varied levels of concern about falling in diverse conditions and the need for context-specific interventions to mitigate FOF and related issues.

Keywords

Community-Dwelling, Fall Efficacy, Falls, Fear of Falling, Older Adults, Self-Efficacy

Introduction

As populations age worldwide, the health and well-being of older adults have become increasingly critical areas of research and public health concern. Among the multi-fold challenges faced by this demographic, fear of falling (FOF) stands out as a significant issue with far-reaching implications on mobility, independence, and overall quality of life.¹ FOF refers to an individual's perceived risk or anxiety about falling, which can lead to activity restriction, social isolation, and diminished physical function.² It has been defined as a continuing concern characterized by walking anxiety or excessive worry about falling, which may affect older adults by limiting their activities of daily living (ADLs).^{3,4} FOF is not only a consequence of previous falls but also a predictor of future falls.⁵ The prevalence of FOF among older adults varies globally, with studies indicating rates ranging from

20% to 85%, depending on the population and assessment methods used.⁶ FOF is reportedly present even among those who have not experienced any history of falls. Therefore, FOF is considered a health problem and needs urgent attention and feasible measures in the immediate future. FOF has been increasingly reported in community-dwelling older adults, with a prevalence ranging from 20 to 85%,^{3,7,8} being present even among those who have not experienced any type of fall.^{3,8} In India, the population of older adults is rapidly increasing, projected to reach 19% of the total population by 2050.⁹ This transition emphasises the importance of addressing age-related health concerns, including psychological and functional impacts of FOF leading to falls in older adults. The prevalence of falls among the elderly population is 11.43% (N=3282) in India.¹⁰ However, limited empirical research has explored FOF among older adults in India, particularly concerning rural-urban disparities.

In the context of rural and urban environments, older adults may experience unique challenges and risk factors that influence their perception of FOF. Rural and urban environments in India differ significantly in terms of infrastructure, healthcare access, and social support systems, which can influence the risk and perception of falls among older adults.¹¹ Urban areas often offer greater access to healthcare services, recreational facilities, and social support networks, which may mitigate feelings of fear and apprehension among older residents. Conversely, rural areas may present environmental barriers such as uneven terrain, limited access to healthcare, and social isolation, which could exacerbate FOF among older adults. A major portion of older adults continues to reside in rural areas and, therefore, might be closely affected by FOF. However, testing tools and related data are not readily available from rural regions, and it largely remains unknown about the belief and confidence in balance and about FOF.

Understanding the interplay between age, gender, and residential setting in relation to FOF is essential for developing targeted interventions to support older adults in rural and urban communities. Previous research has suggested that older age and female gender are associated with higher levels of FOF, while the influence of residential setting remains less explored. Therefore, investigating FOF among older adults in rural and urban areas of India can provide valuable insights into the

factors contributing to FOF and inform the development of context-specific interventions.

The present cross-sectional study aims to assess FOF among adults aged 60 years and above, residing in the community in rural and urban areas in India. By examining age and gender-related differences in FOF scores and exploring the impact of residential setting, this research seeks to contribute to the understanding of the complexities surrounding FOF among older adults in diverse environments. The outcomes of this study could guide focused strategies to reduce FOF and enhance the well-being of older adults in rural and urban areas in India.

Methods

Study design and participants

A cross-sectional study design was employed, targeting community-dwelling older individuals aged 60 years and above living in rural and urban areas of Jaipur, Rajasthan, India. A total of 220 older adult participants were recruited through convenience sampling. A structured interview was conducted to collect demographic information and FES-I scale scores to assess FOF. The study is a part of a PhD project, and the ethical approval was obtained from the Institutional Ethics Committee MGUMST, Jaipur, India. The study was designed and reported in accordance with the STROBE guidelines.

Inclusion and exclusion criteria

Participants were included if they were community-dwelling Indian older adults aged 60 years and above, able to hear and comprehend the administrator's commands, and ambulant with/without the use of a walking aid. The exclusion criteria included being home-bound, institutionalized, wheelchair bound; inability to ambulate with/without the use of a walking aid or physically related personal assistance, having a history of neurological conditions like stroke, Parkinson's disease, etc., and those with a history of surgical intervention to the lower extremity or spine.

Outcome measure

FOF was assessed using the Falls Efficacy Scale-International (FES-I), a validated tool that measures the level of concern about falling during various activities of daily living.¹² The FES-I consists of 16 items, each scored on a 4-point scale, with total scores ranging from 16 (no concern) to 64 (severe concern). The Hindi version of the FES-I, validated for use among Indian older adults,¹³ was utilized in this study to ensure cultural relevance and ease of comprehension among participants, enhancing the reliability of the findings.

Procedure

The participants were first informed about the study objectives, and written informed consent was obtained. Information about demographic details (age, locality, and sex), and response to the questions of the Falls Efficacy

Scale- International (FES-I). The FES-I was administered via face-to-face structured interview among the participants.

Statistical analysis

Data was analysed using IBM SPSS Statistics version 27.0. Results for descriptive statistics were reported using mean and standard deviation. The independent t-test was used for comparison of FOF scores between male & female participants belonging to rural and urban areas. The correlation between age and FES-I score was determined using the Pearson correlation test. A p-value of ≤ 0.05 was considered statistically significant.

Results

Participant characteristics

The study involved a total of 220 participants, comprising 119 male participants and 101 female participants. Information regarding the locality of participants (urban or rural) and gender (males or females) for age, FES-I score is depicted in Table 1. This table also mentions the number of participants in each subgroup (urban males, rural males, urban females, rural females).

Descriptive data show rural participants (n=108) consisted of 63 females (mean age 69.05 ± 7.50 years; mean FES-I score 34.08 ± 10.70) and 45 males (mean age: 70.73 ± 6.50 years; mean FES-I score: 34.20 ± 11.48). Urban participants (n=112) consisted of 38 females (mean age 65.79 ± 5.16 ; mean FES-I 19.29 ± 4.25) and 74 males (mean age 68.09 ± 5.71 ; mean FES-I 19.73 ± 3.99) (Table 1).

FOF scores

The study revealed significant differences in FOF between rural and urban participants, with higher mean FES-I scores observed in the rural group (34.13 ± 10.97) compared to the urban group (19.58 ± 4.07). This difference was statistically significant, $t: 13.13$, $df: 218$, $p < 0.01$, with a mean difference of 14.55 (Tables 2 & 3).

When analysed by gender, females (28.51 ± 11.38) reported higher FES-I scores than males (25.20 ± 10.42). An independent t-test confirmed this difference as statistically significant, $t: 2.25$, $df: 218$, $p < 0.05$, with a mean difference of -3.13 (Table 3). Further, independent t-tests examining rural-urban differences within gender groups revealed that rural males scored significantly higher than urban males (mean difference = 14.47; $t: 9.92$, $df: 108$, $p < 0.001$), and rural females scored significantly higher than urban females (mean difference = 14.79; $t: 8.13$, $df: 108$, $p < 0.01$) (Table 3).

Comparison of age between gender and locality

A one-way ANOVA was conducted to compare the mean age of respondents across groups based on gender and locality. The results revealed a statistically significant difference in mean age between groups, $F(3,216): 4.418$, $p < 0.01$, indicating that at least one group differed from the others.

Residence	Variable	Total (n: 220)	Male (n: 119)	Female (n: 101)
Total (Rural + Urban)	Age	68.51 ± 6.50	69.09 ± 6.13	67.82 ± 6.87
	FES-I Score	26.72 ± 10.97	25.20 ± 0.42	28.51 ± 11.38
	n	108	45(41.7%)	63 (58.3%)
Rural	Age	69.75 ± 7.12	70.73 ± 6.50	69.05 ± 7.50
	FES-I Score	34.13 ± 10.97	34.20 ± 1.48	34.08 ± 10.70
	n	112	74(66.1%)	38 (33.9%)
Urban	Age	67.31 ± 5.61	68.09 ± 5.71	65.79 ± 5.16
	FES-I Score	19.58 ± 4.07	19.73 ± 3.99	19.29 ± 4.25

FES-I: Falls Efficacy Scale-International; Age in years

Variable	Rural (n: 108)	Urban (n: 112)	MD	t	P
Age	69.75 ± 7.12	67.31 ± 5.61	2.47	2.85	<0.005
FES-I score	34.13 ± 10.97	19.58 ± 4.07	14.55	13.13	<0.000

FES-I: Falls Efficacy Scale-International; MD: mean difference

Gender	Total (Rural + Urban)	Rural	Urban	Rural vs. Urban, MD, t, P
Male	25.20 ± 10.42	34.20 ± 1.48	19.73 ± 3.99	14.47, 9.92, <0.05
Female	28.51 ± 11.38	34.08 ± 10.70	19.29 ± 4.25	14.79, 8.13, p<0.05
Male vs. Female (MD, t, P)	3.13, 2.25, <0.05	0.12, 0.06, 0.65	0.44, 0.54, 0.86	

MD: mean difference; FES-I: Falls Efficacy Scale-International

Comparison Group 1	Comparison Group 2	MD	SE	P	95% CI
Rural men	Urban men	2.64	1.20	0.127	-0.47 to 5.75
Rural men	Rural women	1.69	1.24	0.526	-1.52 to 4.90
Rural men	Urban women	4.94	1.39	0.003	1.31 to 8.57
Urban men	Rural women	-0.95	1.09	0.818	-3.77 to 1.87
Urban men	Urban women	2.31	1.27	0.267	-0.98 to 5.58
Rural women	Urban women	3.26	1.30	0.063	-0.64 to 6.63

ANOVA (overall test): F (3,216) = 4.418, p = 0.005; SE: Std. Error; MD: mean difference

Gender	N	r	P
Male	119	0.194	0.035
Female	101	0.213	0.033
Total	220	0.185	0.006

FES-I: Falls Efficacy Scale-International; n: number of participants; r: Pearson correlation coefficient

To identify the source of this difference, Tukey HSD post-hoc comparisons were performed. The analysis showed that urban women had a significantly higher mean age compared to rural men (Mean Difference: 4.94, p<0.005, 95% CI: 1.31 to 8.57). No other pairwise comparisons were found to be statistically significant, although the difference between rural women and urban women approached significance (Mean Difference: 3.26, p = 0.063). These findings suggest that age distribution differed primarily between rural men and urban women, while other group comparisons did not show significant variation.

Association of age and FES-I scores

Pearson correlation coefficients were computed to assess the relationship between age and FES-I scores for all older adults in the study, as well as within both the gender groups. The values of the Pearson correlation coefficient, its significance value, and interpretation are mentioned in Table 5.

Overall (n=220), age showed a weak but significant positive correlation with FES-I scores ($r = 0.185$, $p < 0.01$). In gender-specific analyses, correlations were positive for both males ($r = 0.194$, $p = 0.34$) and females ($r = 0.213$, $p = 0.33$), but not statistically significant.

Discussion

Rural-urban disparities in FOF

Various international and Indian studies indicate higher FOF among those residing in less resource-rich environments.^{6,11} This current study also investigated the impact of residential setting on FOF among older adults. Interestingly, while FES-I scores were higher in participants from the rural areas compared to their counterparts, the difference was statistically significant, indicating greater concern about falling. This finding aligns with previous research suggesting that older adults from rural areas face a unique set of environmental and systemic challenges that can exacerbate FOF.^{6,11,14} The FOF in rural areas may be shaped by uneven terrain, limited infrastructure, poor lighting, lack of paved walkways, and restricted access to assistive devices or rehabilitation services.¹¹⁻¹⁴ Rural residents may also face limited healthcare access,¹⁵ lower health literacy,¹⁶ and greater social isolation due to geographical barriers.¹¹⁻¹⁷

Currently, around 71% of Indian older people live in rural areas.¹⁸ With a large proportion of older adults already experiencing difficulties accessing healthcare due to health or geographic factors, and with this number set to increase with the ageing population, it is imperative to identify methods to bridge inequities in healthcare access for older adults and to alleviate rising costs to the healthcare systems.¹⁹ Concurrently, the incidence of falls is higher among rural than urban older people.^{20,21} The prevalence of perceptible fear of falling was significantly higher in the rural population than that in the urban one and increased with aging in both rural and urban areas.²²

Age-related differences in FOF

Consistent with previous research, our study showed a modest association between age and FOF, with scores increasing as age advanced, reflecting greater fall-related fear among older adults. Although this relationship was not statistically significant when males and females were analysed separately, likely due to smaller subgroup sizes or variability, the trend supports the concept of age-related declines in physical function, balance, and sensory perception. These findings highlight the trajectory of FOF across the lifespan and emphasize the importance of age-sensitive, cohort-specific interventions to address fall-related fears.

Gender disparities in FOF

Another significant finding of our study was the gender disparity in FOF, with females consistently reporting higher scores than males across both areas. Rural females emerged as the most affected group, highlighting their vulnerability and the need for targeted interventions. This gender difference in FOF, widely documented in the literature^{23,24,25,26} and may be attributed to numerous factors, including differences in physical strength, balance confidence, and perception of risk. Additionally, societal expectations and cultural norms may influence gender-specific attitudes towards falls and fear avoidance behaviours. Recognizing these gender disparities is crucial for tailoring interventions that address the unique needs and concerns of older women, thereby empowering them to maintain independence and engagement in daily activities. The higher FOF among females is consistent with global trends, where women often report greater concern about falling, potentially due to higher rates of osteoporosis and lower muscle strength.⁶ Kumari and Dsouza in 2015,²⁷ concluded that the rural and urban elderly differ in intrinsic risk factors, circumstances and consequences of fall, and in socioeconomic and environmental risk factors. A fall prevention programme should be tailored specifically for the two populations for optimum results²⁸. The interaction effect observed suggests that rural females are particularly vulnerable, necessitating targeted interventions.

Implications for public health interventions

This cross-sectional study sheds light on the intricate relationship between age, gender, and residential setting in shaping fear of falling among older adults living in the community. By identifying vulnerable subgroups, particularly older women in rural areas- the findings emphasise the urgent need for targeted fall prevention strategies that are sensitive to both the demographic profile and environmental context of the population. The insights gained from this study have important implications for public health strategies aimed at reducing FOF and promoting the well-being of older adults in rural and urban areas in India. Interventions targeted at older adults should incorporate multifaceted approaches that address physical, psychological, and environmental factors contributing to FOF. Programs designed to enhance strength and balance, improve confidence in mobility, and provide education on fall prevention can empower older adults to mitigate their fear of falls and maintain active, independent lifestyles. In rural areas, where access to healthcare and rehabilitation services may be limited, community-based initiatives are particularly critical. Moreover, community-based initiatives that foster social connectivity and support networks can help alleviate feelings of isolation and anxiety among older adults, particularly in rural areas where resources may be limited. Culturally sensitive and locality-adapted strategies are essential to ensure equitable access and effectiveness across diverse residential environments²⁹.

Risk factors for falls in older people vary according to the characteristics of their living areas, and relevant

interventions should be targeted according to the characteristics of falls occurring in different residential areas.³⁰ The association of increasing age with higher FOF emphasizes the importance of tailored interventions to address FOF, particularly in rural areas and among ageing females. Taken together, these findings highlight the complex interplay between environmental, social, and demographic factors in shaping capital FOF among older adults. Addressing these disparities will require multifaceted interventions that go beyond modifying the physical environment to include community engagement, access to healthcare, and education on fall prevention.

Limitations and future directions

While this study provides valuable insights into FOF among older adults in rural and urban areas in Jaipur, Rajasthan, India, several limitations should be acknowledged. The cross-sectional design precludes causal inference, and longitudinal studies are needed to explore the temporal relationship between age, gender, residential setting, and FOF. Additionally, the convenient sampling method may limit the generalizability of the findings, and future research with randomization and larger sample sizes is warranted to confirm and extend our results. Furthermore, qualitative investigations may provide deeper insights into the lived experiences and perceptions of FOF among older adults, complementing quantitative assessments.

Conclusion

This cross-sectional study provides insights into the prevalence of higher FOF among older adults in rural than urban areas in India, and significantly higher FOF is observed in females in both rural and urban areas. Outcomes of the study highlight the need for customized interventions to address FOF and address the unique challenges faced by older individuals in distinct environments, and enhance the well-being of older adults in diverse settings. Timely screening, specific need identification, and education on fall prevention and monitoring diverse mechanisms underneath FOF in rural and urban areas may contribute to reducing the burden of falls and enhancing quality of life and healthy ageing at large.

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Ethical statement

Ethical approval was obtained from the Institutional Ethics Committee MGUMST, Jaipur, India (EC/NEW/INST/2022/RJ/0097). Informed consent was obtained from all participants.

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Case Report

A unique case of transverse myelitis that improved with plasmapheresis: a case report

Yumi Jakobsson, Srinidhi Mohan Chitra, Anthony Oke

Abstract

We report a case of a patient with a background of suspected lung malignancy, Behçet's disease, and prior radiotherapy, who presented with acute left lower limb weakness, sensory loss, and bowel and bladder dysfunction. Imaging revealed thoracic spinal cord signal changes and periventricular brain lesions suggestive of an inflammatory demyelinating process. Extensive workup for malignancy, infection, and autoimmune conditions was inconclusive. The patient failed to improve with high-dose corticosteroids but showed a significant response to plasma exchange. This case highlights the diagnostic challenges of idiopathic myelopathy and supports early consideration of plasmapheresis in seronegative presentations.

Keywords

Neuroimmunology, Plasma Exchange Therapy, Transverse Myelitis

Introduction

Transverse myelitis (TM) is a rare but potentially disabling inflammatory disorder of the spinal cord.¹ It can be idiopathic or secondary to autoimmune, infectious, paraneoplastic, or post-radiation aetiologies.² Diagnosis requires careful exclusion of other causes and is supported by neuroimaging and cerebrospinal fluid (CSF) analysis.² This case highlights an unusual presentation of suspected idiopathic inflammatory myelopathy in a patient with complex comorbidities.

Case presentation

This is a case of a male in his late 50s with a background of suspected right lung malignancy (previously treated with radiotherapy), Behçet's disease, chronic kidney disease, monoclonal gammopathy of undetermined significance, left adrenal adenoma, pulmonary hypertension, and chronic obstructive pulmonary disease. At presentation, the lung lesion had not been biopsied, so malignancy remained unconfirmed. Six months later, a histological diagnosis had still not been established.

He presented with an acute onset of left buttock and leg pain, worsening over 5 days, progressing to paraesthesia

and weakness in the left lower limb. He developed bladder dysfunction requiring catheterisation and bowel incontinence.

On examination, he was fully oriented and cranial nerves and upper limb functions intact. Neurological findings revealed increased tone, reduced power (2-/5), and brisk reflexes in the left lower limb. Right lower limb motor function was normal. There was reduced sensation to light touch and pinprick at the T4 dermatome bilaterally. Vibration sensation was reduced to the ankles bilaterally, with preserved joint position sense.

Investigations

Magnetic resonance imaging (MRI) spinal imaging showed no metastatic compression, with a minor disc bulge at L5/S1 and a T3–T6 signal abnormality suggestive of inflammation or demyelination. Contrast MRI brain and spine imaging later revealed multiple white matter lesions, with slight regression of spinal changes, supporting a non-metastatic inflammatory process. CSF showed normal glucose, mildly elevated protein, no malignant cells, and negative cultures and polymerase chain reaction (PCR). Results later available confirmed identical IgG oligoclonal bands in serum and CSF, indicating systemic inflammation. Cytology from CSF remained negative.

Blood tests showed elevated C-reactive protein of 158mg/L and transient neutropenia, with no infection identified. Autoimmune screening, including antinuclear antibodies, antineutrophil cytoplasmic antibodies, extractable nuclear antigens, double-stranded DNA, anticardiolipin antibodies, and lupus anticoagulant, were negative. Serum copper and angiotensin-converting enzyme levels were normal. Paraneoplastic antibodies and serologies for HIV, syphilis, hepatitis B and C, Lyme disease, and aquaporin 4 were negative. Serum free light chains were elevated, with reduced IgG and IgM. Nerve studies showed peripheral neuropathy without denervation or radiculopathy. CT imaging confirmed progression of the lung lesion, but no metastasis or other cause for symptoms. Specialist reviews from dermatology and ophthalmology found no active Behçet's disease.

Differential diagnosis

The initial working diagnosis was metastatic spinal cord compression, which was excluded following an MRI of

the spine. Other considerations included paraneoplastic myelopathy, neuro-Behçet's syndrome, post-radiation myelitis, infectious myelitis, and idiopathic TM. No pathogens were identified to suggest an infective cause, and given the regression of spinal cord lesions and improvement following immunomodulatory treatment, paraneoplastic and infectious causes were deemed unlikely. The absence of dermatological and ophthalmological features, in combination with a lack of response to steroids, made active neuro-Behçet's syndrome improbable. Radiation-induced myelopathy was considered but felt less likely given the timing, anatomical distribution, and regression on follow-up imaging.

Treatment

The patient was initially managed with high-dose intravenous corticosteroids, with minimal clinical response. Following neurological consultation, based on suspicion of an autoimmune or idiopathic inflammatory aetiology, he underwent a five-day course of plasma exchange (PLEX) in collaboration with the renal team, who agreed to insert a temporary central line and deliver membrane-based plasmapheresis in the dialysis ward using haemodialysis.

PLEX is a treatment that involves the exchange of blood plasma to eliminate pathogenic substances such as autoantibodies, immune complexes, or toxins.³ Antibiotics were also administered due to neutropenic fevers, though no source of infection or pathogens was identified.

Outcome

Following completion of PLEX, the patient showed significant neurological improvement, including partial recovery of motor function in the left lower limb. He regained the ability to sit unsupported and exhibited improved sensation below the T4 level. Residual deficits included left-sided weakness (power 3-/5), thigh muscle wasting, and ongoing bowel incontinence. He remained catheterised.

At the time this case report was written, the patient was undergoing inpatient neurorehabilitation with ongoing improvement in strength and mobility.

Discussion

There are many studies on autoimmune disorders of the nervous system.⁴ Even though studies attempt to understand the autoimmune system, there are multiple mechanisms that can affect breakdown of immune tolerance, which affects peripheral tolerance more than central tolerance.⁵

This case illustrates the complexity of diagnosing TM in the context of suspected malignancy and autoimmune disease. Although many potential causes were investigated, the patient's clinical course, imaging findings, and positive response to PLEX pointed toward an idiopathic or seronegative autoimmune myelopathy.

While radiotherapy-induced myelopathy can present with delayed onset, the thoracic cord involvement and periventricular brain lesions suggested an inflammatory demyelinating process. This case highlights the importance of early multidisciplinary involvement and consideration of immunomodulatory therapy in patients with progressive myelopathy and inconclusive diagnostic workup.

Similar cases have been published in the literature where the cause is unidentifiable for TM.^{6,7} This illustrates the need to invest in further research for potential antibodies causing immune tolerance, not only to predict outcome but also risk of recurrence.

Conclusion

TM may present as a rapidly progressive neurological deficit. Such presentations warrant urgent neuroimaging and a comprehensive immunological workup to identify potential underlying causes and initiate timely treatment. A negative paraneoplastic or infectious screen does not exclude an immune-mediated pathology. In selected cases, empirical plasmapheresis may be considered, particularly when clinical suspicion remains high despite inconclusive diagnostic findings.

In oncological patients, idiopathic TM can occur and may be difficult to distinguish from paraneoplastic or radiation-induced aetiologies. Differentiation requires careful clinical assessment and consideration of the patient's cancer history and treatment exposure.

Clinical improvement following PLEX may suggest an antibody-mediated pathogenesis, even in the absence of a confirmed autoantibody. This therapeutic response supports the use of immunomodulatory strategies in cases where diagnostic clarity is limited.

Ethical statement

Patient has provided written informed consent.

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Review

A legal perspective on the rights and welfare of older adults in India

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Abstract

Background: India's rapidly aging population faces increasing health, social, and economic vulnerabilities. Although several laws and welfare schemes exist, gaps in implementation and awareness continue to undermine their effectiveness. **Aims:** This article examines the existing legal framework for the rights and welfare of older persons in India, evaluates its strengths and shortcomings, and recommends reforms for a more inclusive, rights-based approach. **Method:** An analysis of primary legislation, such as the Maintenance and Welfare of Parents and Senior Citizens Act, 2007, the Rights of Persons with Disabilities Act, 2016, and personal laws, was conducted, supported by comparative insights and policy literature. **Results:** Findings reveal that while legal provisions reflect progressive intent, they suffer from fragmentation, poor execution, and a lack of geriatric-specific healthcare integration. **Conclusions:** Stronger enforcement, unified elder-care legislation, and a shift in perspective from welfare to legal entitlement are necessary to ensure older adults in India live with dignity, autonomy, and full participation.

Keywords

Acts, Aged, Elder Abuse, India, Legislation, Older Adults, Patient Rights, Welfare

Introduction

India is undergoing a significant demographic shift, with the elderly population (aged 60 and above) rising rapidly due to advancements in healthcare and increased life expectancy. As per the 2021 *Elderly in India* report by the Ministry of Statistics and Programme Implementation, by 2050, nearly 19.5% of the population will be over sixty (60).¹ Despite this demographic transformation, India's legislative and healthcare frameworks for geriatric care remain fragmented, inadequately resourced, and largely reactive rather than preventive. A national study in 2019 revealed that two-thirds of older respondents faced financial crises, while four-fifths were dependent on family for basic needs and daily living.² The burden on families has intensified over the past two decades, with disintegrating joint family systems, increased migration, and weakening traditional support structures. Coupled

with physical frailty, mental health challenges, and functional decline, older individuals are increasingly vulnerable to neglect, abuse, and exploitation.^{3,4} In such a context, ensuring the maintenance, welfare, and dignity of older adults is a pressing concern.⁴

In the above context, the objective of the review article was to review the existing statutes for senior citizens in India, highlighting their gaps, implementation failures, and the need for robust, contextually sensitive reforms. The constitutional rights and different acts enacted to protect, promote, and maintain the legal rights to live with dignity in society were explored to formulate a review pertaining to the geriatric population.

Legal protections for the older adults in India

Constitutional Provisions

A constitutional provision is any rule, principle, or clause formally set into a nation's constitution - the highest legal document that describes the makeup, authority, and duties of the government and the rights and obligations of its citizens. Essentially, it is a legally enforceable vow by the state and the basis for all laws and policies that come after. On the part of Indian older citizens, constitutional provisions do not necessarily refer to older persons in themselves but establish a legal and moral framework that obligates the state to be accountable for their welfare. The provisions do recognize the role of the state to safeguard, assist, and enhance the dignity and well-being of older persons and, therefore, are the forebears of special welfare legislation for senior citizens.

The following articles of the Indian Constitution have provisions in the legal framework to protect the rights of older adults, which are enumerated.

- a) Article 41 - The state shall, within the limits of its economic capacity and development, make effective provision for securing the right to work, to education, and to public assistance in case of old age, sickness, and disability.
- b) Article 46 - The state shall promote with special care the educational and economic interests of the weaker sections of the people and protect them from social injustice and all forms of exploitation, which implies that the senior citizens, being a special section of the weaker section, should be protected from all forms of exploitation and abuse.⁵

Table 1: Summary of the acts in India relevant for older adults	
Acts	Areas covered
Maintenance and Welfare of Parents and Senior Citizens Act, 2007 (MWP Act 2007)	(a) Maintenance support for older adults. (b) Legal and police service at the doorstep.
Mental Healthcare Act, 2017 (MHCA 2017)	(a) Protection of the rights of older adults. (b) Rehabilitation of older adults, when there is no family.
Hindu Adoption and Maintenance Act, 1956 (HAMA 1956)	Both son and daughter have to take care of their older parents.
Rights of Persons with Disabilities Act, 2016 (RPwD Act 2016)	Disability benefits for physical and mental disability are assured
Bharatiya Naya Sanhita (BNS), previously Indian Penal Code (IPC), 1860	Protection against the abuse of older adults and theft of property.
Legal Service Authority Act, 1987	Free legal aid and justice in economic, physical, and property disputes.
Indian Succession Act, 1925	The right to acquire property when the predecessor is dead.

c) Article 21 - The "right to life" under Article 21 is not a right to live or survive, but a right to live with dignity, autonomy, security, and proper care. This includes access to healthcare, proper shelter, economic security, freedom from abuse and neglect, and the right to make decisions about one's own life.

Acts relevant for older adults in India

There are various Acts and legal provisions supporting older adults and various aspects of their care. A summary of the acts is given in Table 1.

Maintenance and Welfare of Parents and Senior Citizens Act, 2007

In the Indian traditional system, which promotes social cohesion, the value of parents has taken on a new dimension in the last two decades because of social changes like industrialization, urbanization, and migration. All these factors contributed to the neglect of the older adults, necessitating legal provisions to assist the senior citizens in securing maintenance support from their children. The MWP Act, 2007, has enabled the provision to secure maintenance support through the tribunal (notified as assistant commissioner/sub-divisional officer of the state) with the powers of a civil court under this act. This act seeks maintenance by removing the necessity of a lawyer to represent the case, or the tribunal can take suo motu cognizance. There is also a provision for facilitating amicable settlement through assistance.

Key Features of the Maintenance and Welfare of Parents and Senior Citizens (Amendment) Act, 2019,⁷ are given below.

1. Expanded Definition and Scope of Responsibility: The bill redefines "children" to include daughter-in-law and son-in-law, expanding legal responsibility for care. It also broadens the meaning of "welfare" to include comprehensive physical and mental well-being, not just financial support.

2. Flexible Maintenance Amount: The earlier maintenance cap of ₹10,000 per month has been removed. Tribunals now have the discretion to determine suitable maintenance based on the senior citizen's needs and the financial capability of the children or relatives.

3. Faster and Prioritized Tribunal Proceedings: The disposal of applications will be based on the date of receipt rather than the date of notice. Additionally, cases involving individuals aged 80 and above will be given priority with stricter timelines for resolution.

4. Strengthened Support and Oversight Mechanisms:

a) Maintenance officers will act as single-point support resources to guide senior citizens.

b) Nodal officers in police stations and special police units at the district level will ensure better enforcement and protection.

c) A national helpline with a common toll-free number will provide immediate assistance and enhance safety.

5. Better Regulation of Senior Care Services: The bill introduces enhanced regulation for senior citizen care homes, day care centres, and home care services to ensure standardized and quality service delivery.

6. Improved Accessibility and Legal Remedies: Senior citizens can now submit maintenance applications online, improving access. The right to appeal has also been extended to children and relatives in line with natural justice.

This act is perhaps the most articulate legal response in India to the issue of old age care. It binds legal heirs and adult children to give monthly maintenance to senior citizens who cannot maintain themselves. Though its motive is humanitarian, its implementation is poor. The main hindrance in the implementation of this act is complicated administrative issues, delays in the

completion of appeals in high courts, a lack of old age homes, challenges in the treatment of chronic cognitive disorders in old age, and protection of life and property because of physical and financial abuse.⁸ The prevalence of elder abuse is one of the major public health problems and is considered a significant violation of human rights. Indian studies have also indicated a significant prevalence of elder abuse. The prevalence studies done by Mehra et al. indicated that 41.6% of the older adults reported abuse.⁶ In contrast, other recent studies by Panruti et al. and Sathya et al. reported a prevalence of 25.6%, with predominant abuse being psychological.^{8,9} The tribunals are overwhelmed, older litigants have mobility issues, and social shame keeps parents from taking legal action against their children.

Mental Healthcare Act, 2017

The Mental Healthcare Act, 2017 (MHCA, 2017) is a paradigm shift from custodial and sometimes punitive management of mental illness to a rights-based and patient-centered one. MHCA 2017, which came into force in May 2018 in India, has a significant implication for the geriatric population in promoting mental health care and protecting the rights of the geriatric population.¹⁰ MHCA 2017 emphasizes specialized clinical services for older adults in mental health care institutions. Older adults with mental health problems such as dementia have a high risk of loss of mental capacity, abuse, violation of their rights, and institutionalization. Rehabilitation services for the older adults are a significant development emphasized in this act because of social breakdown in society. Several provisions of the act, such as those related to mental capacity, advance directives, the nominated representative (NR), and the responsibilities of other agencies, have specific challenges related to older adults with mental illness.^{8,9}

The MHCA 2017 Section 18(4)e articulates that provision of old age mental health services at each district level is a right under the "Right to access mental health care," and if not fulfilled, compensation must be provided as per section 18(5)f. MHCA 2017 also emphasizes that old-age patients shall not have to travel a long distance to avail themselves of these old-age mental health services as per section 15(5)d. Sections 100 and 101 of MHCA 2017 specify the responsibilities of police in the management of wandering persons with mental illness (PMI). Older adult patients with cognitive impairment and dementia have a high risk of wandering behaviour. They are more vulnerable due to the difficulty in proper communication. Proactive assistance from the police would be very helpful for the appropriate care of wandering older adults with dementia and other mental illnesses.^{11,12}

In view of the above-mentioned parameters of the MHCA 2017, the rehabilitation, elder abuse, violation of rights of senior citizens, and management of PMI by the police will be the future challenge for the appropriate government and concerned stakeholders related to the act. But though progressive on paper, the implementation of the act is hindered by the unavailability of trained manpower, financial limitations, and urban-rural disparity in mental

healthcare. However, India's advance directive provision is progressive, particularly in a part of the world where mental health remains. In many states of India, MHCA 2017 is still not implemented with new rules and regulations.

Hindu Adoption and Maintenance Act, 1956

The Hindu Adoption and Maintenance Act, 1956 (HAMA), is a central part of the Hindu Code Bills and a pivotal statute with direct impact on the well-being of older persons. The Act enacts into statute the ethical and legal duty of offspring to support their elder parents.¹³ While exclusively aimed at Hindus, Buddhists, Jains, and Sikhs, the Act is consistent with a cultural norm that assigns the initial responsibility for care of the older adults to the family. It enacts that "a Hindu is bound, during his or her lifetime, to maintain his or her legitimate or illegitimate children and his or her aged or infirm parents, if they are unable to maintain themselves." Both sons and daughters must be entrusted with the duty so that there can be gender equality. Notably, this provision runs contrary to the common patriarchal notion that the sons should be the sole caretakers in old age. The word "maintenance" used in the Act is generic. It encompasses not just food, clothing, and shelter but also reasonable medical expenses and other necessities of life. The provision can be enforced through civil action, and children may be required to pay a monthly allowance or a lump sum according to their ability and the needs of the parent.

This act assumes significance in the contemporary backdrop of nuclear families, urban living, and growing abuse of the older adults. With the joint family system itself dwindling, many older people have no informal support structure. The act provides legal succour in such cases and makes the responsibility at the familial level not merely a moral one but one that can be enforced legally.

Section 20 of the Hindu Adoption and Maintenance Act, 1956, is an important provision that grounds the care of older parents on adult children's legal duty. It demonstrates two aspects of the policy of the Indian state: combining personal law and welfare duties, as well as exposing the lacunae still existing across communities. Cementing familiarity and access to this provision will help ensure there is no older person left vulnerable because of family indifference or religious loopholes.¹³

The Rights of Persons with Disabilities Act, 2016

The Rights of Persons with Disabilities Act, 2016 (RPwD Act 2016) received the assent of the President on December 27, 2016. The preamble of this act clearly states that it aims to uphold the dignity of every Person with Disability (PwD) in the society and prevent any form of discrimination.¹⁴ The RPwD Act 2016 is a consolidating legislation enacted to give substance to India's commitment to the United Nations Convention on the Rights of Persons with Disabilities (UNCRPD).¹⁵ The Act replaces the earlier Persons with Disabilities Act, 1995, and introduces new spheres under its canopy by

listing 21 categories of disabilities, the majority of which have a direct relationship with older persons. Of great significance in the RPwD Act is its rights-based and inclusive approach, shifting from a welfare to an empowerment, equality, and dignity approach.¹⁶ While the Act is not senior citizen-oriented, it is highly relevant to them, given that aging comes with disability, i.e., impairment of eyesight and hearing, impairment of mobility, neurodegenerative disorders (Parkinson's and Alzheimer's disease), and mental illness.

The RPwD Act is a person with a disability who has a permanent physical, mental, intellectual, or sensory impairment, which means the inability to function fully and effectively in society. Most older citizens are included in this category, particularly the elderly disabled. The Act mentions those disabilities like locomotor disability, visual impairment, hearing impairment, chronic neurological disorder, and multiple disabilities - all common during old age.

Major provisions of the RPwD Act governing older people are as follows.

a) Equality and Non-Discrimination (Section 3): The Act mandates that the disabled must not be discriminated against and must be accorded equal protection and legal rights. This must be applied to older persons who just happen to be socially excluded or marginalized due to their disabilities.

b) Accessibility (40-46): The Act places firm emphasis on the public infrastructure, transport, information, and communications to be made accessible. For the older citizens with mobility or sensory disabilities, this provision becomes necessary in promoting independent and dignified living.

c) Health and Rehabilitation (25-30): This obliges the government to provide necessary healthcare, rehabilitation centres, and disability prevention awareness. It can prove to be a boon to the geriatric citizenry, especially in rural or backward areas.

d) Reservation in Employment and Education (Sections 32, 34): Although these are essentially intended for disabled youth groups, able and willing older persons, especially in government positions or schemes of lifelong education, can utilize these.

e) Guardianship and Legal Capacity (Section 13): Feeling the fragility of mentally and intellectually disabled individuals common in old age, the Act provides safe decision-making and limited guardianship, ensuring the independence of the older persons.

Lastly, the Rights of Persons with Disabilities Act, 2016, is a robust legislative tool to enhance and defend the rights of disabled older individuals. The act reasserts the state's duty to uphold the dignity, autonomy, and participation of older citizens in all walks of life.

Indian Penal Code (IPC), 1860

The Indian Penal Code (IPC) 1860 is the foundation of criminal law in India, which has now changed to Bharatiya Naya Sanhita (BNS) 2023. The Bharatiya Nyaya Sanhita, 2023, was enacted to consolidate and amend provisions relating to offences. It was enacted recently and has a very important role to play in dealing with offenses against older persons, who are most prone to physical, mental, and financial exploitation in India.¹⁷

Provisions such as sections 323 and 325 (voluntarily causing hurt or grievous hurt), 506 (criminal intimidation), 405 and 420 (breach of trust and cheating), and 498A (husband or relatives' cruelty) are regularly used in elder abuse cases, from assault and intimidation to property coercion and financial exploitation.

Still, the lack of age-specific penal provisions is a glaring omission. In contrast to the Protection of Children from Sexual Offences (POCSO) Act, 2012, or the Protection of Women from Domestic Violence Act (PWDVA) 2005, elder abuse has no focused laws and protections.^{18,19} Older persons are not reported as being abused because they are emotionally dependent on abusers, stigmatized, or fearful of retaliation. And law enforcement is not trained to recognize elder-specific abuse.

While the MWP Act, 2007, provides civil recourse for neglect, it does not suffice unless supplemented by related criminal provisions. To bring effective protection, India requires legislative changes that identify elder abuse as a separate category, require reporting, and guarantee age-sensitive investigation and enforcement. Justice and dignity can only be guaranteed for India's aging population then.

Legal Services Authorities Act, 1987

The Legal Services Authorities Act, 1987, was passed to implement the mandate of Article 39A of the Indian Constitution for free legal aid and equal justice to all, and particularly to the weaker sections. For the older individuals - the majority of whom are confronted with economic, physical, or informational disabilities - this act performs an important function in facilitating access to justice.²⁰

At Section 12, the elderly, especially economically dependent persons, are specifically provided with free legal aid in terms of legal service, counsel, conciliation, and assistance in pursuing cases before courts. Such provisions are ensured by bodies such as the National Legal Service Authority (NALSA), State Legal Service Authority (SLSA), and District Legal Service Authority (DLSA in the form of legal awareness camps, helplines, and *Lok Adalats* - ad-hoc courts providing speedy and less daunting options as compared to regular litigation.

Legal services to older persons frequently include legal assistance in the maintenance of cases, settlement of property disputes, pension cases, or abuse and neglect. Modes such as legal aid clinics at villages and old age

homes, and collaborative ventures with law colleges bring the legal facilities to their doorsteps.²¹

Yet, awareness and access are a problem, particularly in rural areas. Centres are not necessarily age-friendly, and the older adults themselves are not generally aware of their rights. Despite all these defects, the Act is an indispensable safety net, translating constitutional guarantees of equal justice into real-life assistance to India's older citizens.

Indian Succession Act, 1925

The Indian Succession Act, 1925, regulates the distribution of a dead person's property, either by will (testamentary succession) or in the absence of a will (intestate succession). Although the act has always been conceived of as a code for successors, it has very significant protection for older persons, particularly those who have immovable property.²²

For the older adults, the making a will is possibly the most important legal instrument to protect their property and independence. The Act prescribes certain procedures for signing, witnessing, and attestation of wills to make them valid and protect older persons from force or emotional coercion.²¹ Section 61 particularly ensures that the probate of a will is challenged in the case where it has been procured by fraud, coercion, or undue influence, which is critical because most older people are vulnerable.

The act extends to Parsis, Christians, and others, whereas Hindus, Sikhs, Jains, and Buddhists are usually governed by the Hindu Succession Act, 1956, although they may be able to make wills under the said act as well. Muslims are mainly governed by personal law, although provisions of the said Act can also extend.^{22,23}

Although beneficial, awareness levels are low. Most of the older persons are dissuaded by their families or lack access to legal counsel. In spite of this, the act compels them to achieve equitable inheritance, suppress abuse, and acquire dignity by planning estates and being independent.

Discussion

It is important to reflect on the legal framework for older persons in India and highlight the gaps, current realities, and suggest what can be done. Despite having multiple laws related to the protection of older persons in India, the current legal framework is disjointed and not adequately capable of taking on the multidimensional needs of the older persons. Legislations like the MWP Act, 2007, Section 20 of HAMA 1956, and the Legal Services Authorities Act, 1987, establish important rights like maintenance, legal aid, and family obligations. The Indian Penal Code criminalizes abandonment and abuse, but the Indian Succession Act, 1925, and the RPwD Act, 2016, protect inheritance rights and disability rights, respectively. These legislations, however, function in an isolated manner in the lack of a unified, rights-oriented legal framework and, therefore, leaves enormous implementation gaps.

Some key areas remain untouched. There is no Indian legal definition or recognition of elder abuse, and emotional, psychological, and financial abuse continues to be unpunished and invisible. There are no statutory health care entitlements for the older persons, and the National Policy on Older Persons is non-binding. In particular, the field of law and health remains underdeveloped. There is no legislation guaranteeing access to affordable geriatric services, mental health measures, or accountability procedures in old-age homes. Older women, especially widows, are exposed to special vulnerabilities for which current laws do not provide adequate cover.

What is needed is a single, comprehensive Elder Rights Act that integrates civil protections, criminal provisions, healthcare assurances, social security, and affordable redress mechanisms. This legislation must incorporate mandatory reporting of elder abuse, specialized protection officers, laws for elder care homes, and maintenance equality acts for all religious communities. Special attention should be accorded to senior citizen-friendly health centres, cheaper drugs, and governmental duty in the dispensing of pensions and accommodations. Legal assistance should also be more age-sensitive and more accessible via mobile clinics and trained officers.

The challenges are not merely in loopholes of law but in the conditions of day-to-day life—from low literacy and awareness among the older persons to social stigma regarding seeking legal recourse against one's children.

Conclusion

As India is experiencing its demographic transition to agedness, the response to care of the old must shift away from welfare interventions in an individualistic vein towards a unified rights-based approach knitted together at its very centre by dignity, equity, and access. What is needed is fewer schemes but improved implementation - evidence-based, decentralized planning and participative policymaking. Future reform must place the highest priority on cross-cutting elder-care legislation, compulsory geriatric sensitivity training for frontline staff, and investment in community care plans that extend beyond the cities.

Most importantly, attitudes toward older individuals need to change - not as a burden on an already strained system, but as individuals who have lived a life of contribution and continue to contribute to giving. Their lives, social contribution, and decision-making capacity need to guide policy from start to finish.

India has the laws in place, but without compassionate enforcement, inter-sectoral coordination, and sustained supervision, the laws are likely to turn symbolic instead of transformational. The future must be one of a society that does not merely safeguard but also empowers its senior citizens.

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Review

Yoga as a non-pharmacological approach in modulating autonomic function and heart disease management

Divya Sharma, Baburam Sharma

Abstract

Background: Cardiovascular diseases (CVDs) are the primary cause of illness and death worldwide. Recent studies have indicated that yoga may be an effective non-drug intervention with positive effects on heart health. **Objective:** This article aims to investigate how yoga influences heart-related physiological functions and its potential as a complementary approach to cardiac rehabilitation. **Methods:** A comprehensive review of the literature was performed using databases like PubMed, Google Scholar, Embase, and the Cochrane Library. The search included studies and reviews published up to 2024, focusing on the cardiovascular effects of yoga. **Results:** Yoga improves cardiovascular metrics by lowering systemic inflammation and psychological stress while regulating the autonomic nervous system. It leads to lower blood pressure, decreased resting heart rate, enhanced heart rate variability, and better cardiovascular resilience. Mindfulness and yogic breathing improve circulation and reduce the risk of hypertension, stroke, and cardiac arrest. Deep breathing increases oxygen intake, promoting efficient nutrient delivery. Yoga helps alleviate circulatory problems like hypertension, muscle stiffness, and coronary blockages. Vigorous yoga can raise heart rate and cardiac output, increasing systolic blood pressure. **Conclusion:** Yoga is increasingly acknowledged as a beneficial lifestyle change for improving heart health and addressing cardiac issues. However, the effects of yoga on risk factors associated with cardiovascular disease (CVD) are not consistently evident in various studies, highlighting the need for further investigation.

Keywords

Autonomic Dysfunction, Cardiac Rehabilitation, Cardiovascular Diseases, Meditation, Yoga, Yogic Diet

Introduction

Cardiovascular diseases (CVD) continue to be the leading cause of death worldwide, including in India.^{1,2} Research highlights that CVD affects the Indian population approximately ten years earlier than it does Europeans.^{3,4} Statistics show that approximately 52% of deaths related to cardiovascular issues in India occur in people younger than 70 years, compared with only 23% in Western nations.⁵ According to the World Health Organization

(WHO) global report on non-communicable diseases, 17.3 million deaths in 2008 were due to cardiovascular causes, with 7.3 million from heart attacks and 6.2 million from strokes.² Additionally, countries with lower income levels, such as India, experience a higher rate of cardiovascular death than those with middle or high incomes.^{6,7} Although the exact reasons for this difference are not fully understood, a combination of biological factors and social determinants, along with their interactions, likely play a role. This increasing mortality trend represents a growing socioeconomic challenge for India's healthcare system and calls for the development of focused, sustainable intervention strategies.⁸

Risk factors and the need for integrated interventions

Hyperlipidaemia, a major factor in the onset of atherosclerosis and diabetes, has become more common owing to factors such as lack of physical activity, poor eating habits, mental stress, and aging.^{9,10} A 2016 report from the Lipid Association of India pointed out a troubling increase in early-onset atherosclerotic cardiovascular disease.^{11,12} Traditional risk factors for CVD include high cholesterol levels, poor diet, sedentary behavior, and smoking.¹³ Although pharmaceutical and surgical treatments are typically used to manage these conditions, they often fall short because of side effects, poor long-term compliance, and the inability to tackle root causes, highlighting the need for more holistic and integrative strategies, including lifestyle changes and traditional healing practices.

This article aims to investigate how yoga influences heart-related physiological functions and its potential as a complementary approach to cardiac rehabilitation.

Methods

A comprehensive review of the literature was performed using databases like PubMed, Google Scholar, Embase, and the Cochrane Library. The search included studies and reviews published up to 2024, focusing on the cardiovascular effects of yoga.

Results

The role of yoga in cardiovascular care

The Sanskrit word "Yoga" means "union," referring to the merging of personal consciousness with universal consciousness. It includes physical poses (asanas),

breathing techniques (pranayama), and meditation (dhyana) to align the body, mind, and spirit, with the ultimate goal of achieving spiritual freedom (moksha). Yoga has its roots in India's pre-Vedic traditions and began gaining recognition in the Western world in the late 19th and early 20th centuries. However, it has only been in the last 20 years that its therapeutic benefits have been investigated in the scientific and medical fields.¹⁴ Yoga is a cost-effective and efficient method for the management and prevention of CVD. Numerous studies have demonstrated its ability to affect key biochemical markers, such as blood glucose,¹⁵ uric acid,¹⁶ and serum protein levels,¹⁷ indicating Yoga's crucial role in comprehensive cardiac rehabilitation.

Yoga as a primary prevention

Modern urban living contributes to cardiovascular issues such as ischemic heart disease.¹⁸ Mindfulness-Based Stress Reduction (MBSR) techniques, particularly yoga, have been linked to decreased healthcare visits among middle-income urban residents in the United States. Decreased heart rate variability (HRV) and reduced baroreflex sensitivity indicate an increased cardiovascular risk. Controlled slow breathing during yoga can restore these parameters by promoting cardiovascular balance. Mantra recitation slows breathing to approximately six breaths per minute,^{19,20} thereby enhancing HRV and baroreflex function. These improvements led to reductions in respiratory rate, RR intervals on electrocardiogram (ECG), blood pressure, and cerebral blood flow. While the immediate benefits of yogic techniques on autonomic stabilization and cardiovascular function have been documented, their long-term effects on ischemic heart conditions have not been sufficiently studied. Comprehensive longitudinal studies are required to determine whether these effects persist.

The yogic effect on the human body physiology

Research supports the neurohumoral benefits of yoga, such as decreased serum cortisol, catecholamine, and aldosterone levels. The activation of these neuroendocrine pathways is characteristic of various cardiovascular diseases, including hypertension and heart failure. Yoga and meditation increase the levels of melatonin, γ -aminobutyric acid (GABA), and other neuroregulatory substances and reduce stress biomarkers such as 8-hydroxydeoxyguanosine while boosting endorphin levels, demonstrating their efficacy in mitigating psychological and physiological stress.²⁰ Consistent yoga practice reduces oxidative stress and improves endothelial function by enhancing nitric oxide bioavailability.^{21,22} Evidence underscores the role of inflammation in coronary artery disease (CAD) and vascular disorders, with systemic inflammation predicting overall mortality. Yoga shows anti-inflammatory and insulin-sensitizing effects, including increased adiponectin levels and decreased leptin resistance.^{23,24} Mindfulness-based meditation suppresses pro-inflammatory gene expression profiles,^{25,26} and yogic meditation is linked to the downregulation of nuclear factor- κ B-mediated transcription of inflammatory cytokines.²⁷ A study

investigated cardiovascular, endocrine, and inflammatory responses in novice and experienced yoga practitioners before, during, and after Hatha Yoga, comparing them with light walking and passive rest. Experienced practitioners exhibited significantly lower interleukin-6 (IL-6) levels, whereas novices were 4.8 times more likely to show elevated high-sensitivity C-reactive protein (hs-CRP) levels.²⁸ A meta-analysis of 34 studies on mind-body interventions found that such practices reduce inflammatory biomarkers and enhance cell-mediated immune responses, although this analysis was not limited to yoga intervention.²⁹

Yogic effect in modifying coronary risk factors

In contemporary practice, pharmacological treatment remains the primary strategy for hypertension control. Many antihypertensive medications have side effects that can affect patient adherence and treatment success. Moderate-intensity aerobic exercise, such as brisk walking for 30–45 minutes 4–5 times weekly at 40–60% of peak oxygen uptake, reduces blood pressure. It is important to note that although aerobic exercise influences blood pressure management, its impact is less significant than that of medication. A randomized controlled trial (RCT) showed that an 11-week intervention of daily yoga practice, with each session lasting one hour, can be as effective as pharmacological therapy in managing hypertension.³⁰⁻³¹ Yoga, combined with relaxation training, biofeedback, transcendental meditation, and psychotherapy, has demonstrated significant antihypertensive effects. The mechanisms by which yoga lowers blood pressure involve improvements in the autonomic nervous system function. A reduction in the baroreflex sensitivity contributes to the development of essential hypertension,³² the yoga postures, especially inverted or inclined positions, enhance the baroreflex sensitivity. A three-week program incorporating specific yogic postures resulted in autonomic modulation, confirmed through physiological assessments, including cold pressor response (CPR) at 41°C, electroencephalographic alpha index (AI), plasma catecholamine (CA) levels, and plasma renin activity (PRA). These evaluations showed a decrease in sympathoadrenal and renin-angiotensin system activity during yoga practice. Important to note that improvement in baroreceptor sensitivity has been associated with reduced blood pressure in yoga practitioners. In addition to managing primary hypertension, yoga effectively reduces secondary cardiovascular complications associated with chronic high blood pressure. Left ventricular hypertrophy (LVH), a result of prolonged hypertension, indicates various cardiac disorders, including myocardial ischemia, congestive heart failure, and diastolic dysfunction. The head-down-body-up yoga posture, sarvangasana (shoulder stand), has shown clinical benefits in preventing hypertension-induced left ventricular hypertrophy (LVH) and diastolic dysfunction. A two-week sarvangasana intervention led to significant reductions in resting heart rate and left ventricular end-diastolic volume, with a modest decrease in left ventricular mass, as observed through echocardiographic evaluation.³⁴

Table 1: Studies indicating the beneficial impact of yoga and lifestyle modification		
Study type	Intervention	Results
Observational ⁴³	Raja Yoga, single session for short and long term versus the non-yoga practitioners	Improvement in the blood pressure, heart rate, and cholesterol level in the yoga group
Observational ⁴⁴	Yoga, standard LSM for a period of 6 months	Improvement in the coronary heart disease factors among the yoga group
Single arm ³⁰	Asanas, pranayama, and relaxation for a period of 10 days	Improvement in the blood lipid and sugar levels
Single arm ⁴⁵	Meditation and yoga intervention for 6 weeks	Improvement in the blood pressure, heart rate, and body mass. Patients with coronary heart disease had improved endothelial function.
Single arm ⁴⁶	Meditation and pranayama session in a yogic centre	Meditation has been shown to decrease heart rate and lipid metabolism. Pranayama has been shown to increase heart rate and lipid metabolism.
RCT ⁴⁷	Yoga and standard LSM versus CR programme for 12 months	Angina frequency decreased; however, the carotid intima thickness remained the same.
RCT ⁴⁸	Yoga and standard LSM versus the CR programme for 6 months	Improvement in the psychological issues and QOL.
RCT ⁴⁹	Yoga and standard LSM treatment programme versus normal care for 1 year	Regression in the coronary atherosclerosis among the yoga and LSM groups
RCT ⁵⁰	Yoga and standard LSM treatment programme versus normal care for 24 days	Improved exercise tolerance and an increase in LVEF by 6%.
RCT ⁵¹	Yoga, diet plan, and exercise versus a control group for 1 year	The yoga group had less angina, more weight loss, and regression in the coronary atherosclerosis

CR: cardiac rehabilitation; LSM: lifestyle modification; QOL: quality of life; LVEF: left ventricular ejection fraction; RCT: randomized controlled trial

Yogic effect on serum lipid profile and body weight

Obesity is recognized as a major independent risk factor for ischemic heart disease and the associated risk of hypertension. Despite significant efforts, losing weight and maintaining weight often prove difficult and frequently yield less than ideal outcomes. Yoga has gained attention as an effective method to address obesity. A randomized controlled trial found that one year of regular yoga practice resulted in notable improvements in body weight management and composition.³⁵ In another study, participants in an intensive three-month residential yoga and meditation program showed significant reductions in body mass index (BMI), total serum cholesterol, low-density lipoprotein (LDL) cholesterol, and fibrinogen levels, especially in those with high initial values.³⁶ The positive effects of yoga on obesity and hyperlipidaemia cannot be attributed solely to calorie burning, because the physical practice of asanas typically does not involve intense or rapid muscle exertion, instead, the therapeutic benefits of yoga likely stem from its overall impact on metabolic regulation, endocrine function, and stress reduction, making it a valuable nonpharmacological strategy for managing obesity and lipid disorders.

Yogic effect on intrinsic adverse neurohormonal activity

Increased intrinsic neurohormonal activity has been linked to heightened vulnerability to ischemic heart disease, which may clarify how life stressors elevate the risk of cardiac conditions. The extent of detrimental

neurohormonal activity can be measured by evaluating specific markers in the blood and urine. Individuals who consistently engage in yoga asanas have shown a notable decrease in markers of intrinsic neurohormonal activity, such as urinary excretion of adrenaline, noradrenaline, dopamine, and aldosterone, as well as blood levels of testosterone and luteinizing hormone. An experimental study revealed an increase in urinary cortisol excretion.³³ Yoga-based guided relaxation has been found to lower sympathetic activity, as indicated by reductions in heart rate, skin conductance, and oxygen consumption, along with an increase in breath volume, clinical signs of neurohormonal activity, thus offering a protective effect against ischemic heart disease and myocardial infarction.³⁷

Yogic effect on diabetes mellitus

Yoga has been identified as a cost-effective and beneficial therapeutic method that can complement the treatment for non-insulin-dependent (type II) diabetes mellitus (NIDDM). Among patients with diabetes who consistently practiced yoga, there was a notable decrease in the occurrence of hyperglycemia and a reduction in the overall area under the curve in the oral glucose tolerance test. This experimental research indicated a reduced necessity for oral hypoglycemic medications to achieve proper blood sugar control in those who practiced yoga.³⁸ However, the exact mechanism by which yoga exerts its antiglycemic effects is still not fully understood. It is possible that a neurohormonal regulatory mechanism involving insulin and glucagon may be involved.

Table 2: Integrated Yoga Protocol for Cardiovascular Diseases (IYPCD)	
Yogic Practice	Benefits
Asanas (30 minutes)	
Tadasana	• Stress alleviation: The deep breathing and mental concentration inherent in yoga can facilitate relaxation of both the body and mind, counteracting the physiological impacts of emotional stress.
Ardha Matsyendrasana	
Bhujangasan	• Yoga can reduce both systolic and diastolic blood pressure.
Dhanurasan	• Enhanced heart rate variability: Yoga can enhance heart rate variability, which correlates with improved cardiovascular health.
Uttan padasana	• Yoga's focus on meditation and intentional movement may lower the body's inflammatory indicators.
ArdhaShalabasan	• Improved endothelial function
Merudhandasan	• Improved flexibility, muscle strength, and balance
Sethubandhasan	• Yoga helps address stress and behavioural impulses linked to addiction, perhaps serving as an effective aid for smoking cessation.
Gomukhasana	
Shavasana	
Pranayama (15 minutes)	
Deep breathing	• Lowering blood pressure and heart rate
Anulom vilom	• Improving circulation
Brahmari	• Reducing wear and tear on the heart
Sheetali	• Preventing and managing heart disorders
Sheetkari	• Regulating oxygen supply to the heart
Cat stretch breathing	• Improving lung function
Hand stretch breathing	
Relaxation techniques (15 minutes)	
Deep relaxation technique (DRT)	• Reduces stress hormones
Om meditation	• Improves sleep
Yoga nidra	• Reduces anxiety and depression
	• Lowers the risk of angina and supraventricular tachycardia
	• Helps control blood sugar
Yogic diet	• Consume a diet rich in fibre by including plenty of fresh fruits, vegetables, whole grains, and legumes. Incorporate fresh flaxseed oil into your meals. Enhance your diet with more onions and garlic. Include vegetables such as cabbage, cauliflower, Brussels sprouts, and broccoli. Ensure a sufficient intake of green leafy vegetables. Increase the consumption of soy products. Add more dark berries like raspberries, strawberries, blackberries, and blueberries to your diet. Consume oat bran daily as an excellent fibre source. Drink green tea and herbal tea. Aim to drink at least 2 litres of water each day.

Yoga intervention as an alternative to cardiac rehabilitation programme

Cardiac rehabilitation (CR) has been proven to significantly decrease the illness and death rates in individuals with coronary artery disease. However, implementing CR often poses financial difficulties owing to its multidisciplinary approach, which involves services from trained nurses, physiotherapists, cardiologists, and other specialists. In addition, CR programs are not widely available in India, with particularly low participation rates. According to the 2020 global audit by the International Council of Cardiovascular Prevention and Rehabilitation, only one CR spot is available for every 360 patients with ischemic heart disease each year in India, highlighting a shortfall of approximately 3,304,474 places annually.³⁹ The main obstacles to accessing CR include financial limitations and a lack of patient referrals, with the demand for such programs being most significant in the northern regions of the country. Yoga has emerged as a promising alternative to traditional cardiac rehabilitation (CR) in India for several reasons. First, yoga is widely accepted and popular throughout the

country, making it a more accessible and culturally acceptable form of physical activity than conventional rehabilitation exercise. Second, yoga is cost-effective and requires minimal infrastructure or equipment, and only a trained instructor is necessary. Third, the presence of numerous yoga institutions with qualified professionals enables scalable implementation. Moreover, yoga is suitable for home-based practice, and recent advancements in tele-yoga have shown promise in terms of its feasibility, effectiveness, and safety.⁴⁰ Ongoing research continues to explore the potential of tele-yoga to expand the reach of rehabilitation services.⁴¹

In recent years, the resurgence of yoga in India, supported by significant governmental promotion and funding, has established it as a viable component of the national health care framework. Unlike traditional physical training, yoga offers holistic benefits that enhance physical, emotional, and mental well-being. This is particularly relevant given the high prevalence of psychological distress, such as stress, depression, and anxiety, among patients with cardiac diseases. Yoga's comprehensive approach effectively addresses these concerns; furthermore, yoga

practices can be tailored to accommodate various physical capacities. Pranayama provides low-intensity engagement, Vinyasa Yoga offers moderate-intensity exercise, and dynamic Surya Namaskar sequences deliver high-intensity physical activity.⁴² This adaptability facilitates the development of individualized rehabilitation plans based on patient needs and clinical status. Numerous clinical and observational studies have documented positive outcomes associated with yoga and lifestyle modifications in the management and prevention of cardiovascular diseases. These studies demonstrated improvements in key cardiovascular risk parameters, including blood pressure, lipid profile, heart rate variability, and psychological health (Table 1). An Integrated Yoga Protocol for Cardiovascular Diseases (IYPCD) was developed by incorporating evidence-based yogic practices specifically designed for cardiac care (Table 2). This protocol integrates structured physical postures, breathing exercises, meditative techniques, and a Yogic Diet to provide a comprehensive and sustainable model for cardiac rehabilitation and promotion of long-term cardiovascular health.

Discussion

Stress is a constant and unavoidable part of everyday life and plays a significant role in the development of various health issues, particularly coronary heart disease (CHD). Research involving patients with heart disease has shown a significant decrease in clinic visits among those who consistently engage in yoga. Yoga and Pranayama offer considerable health advantages mainly by influencing the hypothalamic–pituitary–adrenal (HPA) axis, which is crucial in stress-related conditions such as type 2 diabetes mellitus (T2DM) and CVD.¹⁸ These practices have demonstrated beneficial effects in a range of conditions, such as hypertension, by increasing the parasympathetic activity through vagus nerve stimulation. This process helps to reduce coronary atherosclerosis and enhance lipid metabolism, body weight, and cholesterol management.⁵² Moreover, yoga improves cardiopulmonary function and boosts physical endurance. It is linked to neuroendocrine regulation relevant to cardiovascular health, marked by decreased sympathetic activity and heightened parasympathetic responses, which improve physical performance and lower levels of inflammatory biomarkers, such as interleukin-6 (IL-6). These physiological changes provide both subclinical and clinical benefits, including lower resting heart rate, higher high-density lipoprotein (HDL) levels, reduced low-density lipoprotein (LDL) levels, less plaque build-up, and fewer arrhythmic episodes requiring revascularization procedures.⁵³ Supporting these results, a 2016 study of 30 medical students aged 18–21 practicing Sudarshan Kriya Yoga for three months showed significant decreases in mean arterial pressure, blood glucose levels, and serum cholesterol levels.⁵⁴

Numerous clinical and observational studies (Table 1) have consistently highlighted the positive effects of yoga and lifestyle changes in preventing and managing CVD. These studies underscore yoga's potential not only as a complementary therapy but also as a cost-effective and

accessible alternative to traditional cardiac rehabilitation, especially in the Indian healthcare setting. Physiologically, the regular practice of asanas and pranayama has been shown to regulate blood pressure, enhance heart rate variability, reduce systemic inflammation, and improve endothelial function. Psychologically, practices such as meditation, yoga nidra, and guided relaxation significantly alleviate stress, anxiety, and depression, which are major contributors to cardiovascular risk.^{55,56,57} Additionally, yoga-inspired lifestyle changes such as adopting a sattvic (balanced) diet, improved behavioral discipline, and mindful living have been linked to better smoking cessation outcomes, weight management, and lipid profile improvement. The IYPCD provides a comprehensive and structured approach that incorporates these multidimensional benefits, making it suitable for the primary, secondary, and tertiary rehabilitation of cardiovascular conditions (Table 2).

In the realm of primary prevention, yoga has gained recognition as a culturally accepted and economical tool for promoting public health education, especially for stress management, balanced nutrition, and physical activity. Introducing yoga into school programs and workplace wellness initiatives can help instill healthy habits at a young age. Community-based efforts, such as weekly yoga sessions, nutritional counselling, and screening for risk factors such as hypertension and obesity, further extend preventive measures. A yogic diet, rich in fibre, antioxidants, and plant-based foods, can greatly reduce the risk of atherosclerosis.⁵⁸ In terms of secondary prevention, implementing the IYPCD immediately after a cardiac event, such as angina or a mild heart attack, helps manage risk factors and aids recovery. Pranayama and yoga nidra are effective for stress management and prevention of recurrence, while regular monitoring of blood pressure, glucose, and lipid levels, along with yogic dietary advice, improves disease management. Additionally, incorporating yoga into non-invasive cardiac care and outpatient settings enhances recovery protocols.⁵⁹ For tertiary prevention, consistent with the IYPCD protocol, patients need to engage in self-care practices, such as pranayama, mindful eating, and adherence to daily routines (*Dinacharya*).⁶⁰ When combined with suitable dietary and lifestyle changes, yoga provides a holistic, sustainable, and culturally relevant method for improving cardiovascular health. The IYPCD model offers a promising, scalable, and cost-effective strategy for tackling India's growing burden of CVD, and could be considered for inclusion in future public health policies and hospital-based care systems in India.

Conclusion

Mind-body practices, such as yoga, combine continuous physical activity with a concentrated inward focus, promoting a temporary state of self-awareness and reflection. Such practices have been shown to offer notable psychological and physiological advantages. Specifically, yoga is believed to trigger neurohormonal responses that enhance health outcomes, as indicated by a

reduction in sympathetic nervous system activity associated with regular practice. Despite these recognized benefits, there is a significant need for systematic scientific research to clarify the specific effects and biological mechanisms through which yoga affects human health in both healthy and diseased states. Yoga has gained recognition as a promising lifestyle intervention that can be effectively incorporated into strategies to prevent and manage CVD. Its wide-ranging benefits, including physiological improvements in blood pressure control, lipid profiles, and autonomic function, as well as psychological benefits, such as stress reduction and emotional resilience, make it particularly suitable for comprehensive cardiac care. Although yoga's global popularity and cultural significance, especially in India, are increasing, evidence regarding its impact on specific cardiovascular risk factors remains inconsistent. These inconsistencies may stem from variations in study design, yoga protocols, population characteristics, and intervention duration. Therefore, while current research strongly indicates the potential of yoga to modify key CVD risk factors such as hypertension, dyslipidaemia, obesity, and stress, more rigorous, standardized, and long-term studies are needed to systematically assess its effectiveness across diverse patient groups. A thorough analysis of the effects of yoga on individual cardiovascular risk factors is crucial to fully comprehend its mechanisms and optimize its use in clinical and public health settings. Incorporating yoga into national cardiovascular health programs, supported by evidence-based protocols such as the IYPCD, could provide a sustainable, cost-effective, and culturally appropriate solution to the growing burden of cardiovascular disease.

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Information

Old age care through hybrid methods of telemedicine and in-person support: GeriCaRe model

Tushar Kanti Das

GeriCaRe (Geriatric Care and Research Organisation) remains active in health and social care of the older adults, through tele and in-person support, alongside research activities. With many projects and activities of care, GeriCaRe is continuing to support the older adults meaningfully.

Healthcamp

GeriCaRe, in association with a local voluntary organisation (Jana Kalyan Samiti), organized a health camp in Arnabal, in Bhadrak district, on 10 November 2025. It addressed the physical and mental health of the attendees. The programme was supported by the Quality of Life Research and Development Foundation (QoLReF) and the Institute of Insight.

Telehealthcare by GeriCaRe

Along with in-person care, GeriCaRe has instituted and maintained telecare through phone and online connections. Dr Prasanta Mohapatra, Dr Tushar Kanti Das, Dr Minerva Samal, Dr Shreyan Kar, Dr Piyush Sahu, Dr Shivangi Panda, and Dr Nilamadhab Kar have supported the older adults for their various ailments. Tele-assessment and management are highly appreciated, as they are timely, remove waiting time, and avoid unnecessary travelling. GeriCaRe requires further resources to develop this through an App and an Online site.

Research

Research-active organisations understand the needs of the population better and provide improved evidence-based care. GeriCaRe is conducting research in partnership with the Mental Health Institute of SCB Medical College, Cuttack. Prof Sarada Prasanna Swain is coordinating research on the mental health of the admitted older adults and exploring their stressors and any negative experiences. This will highlight the missing, unidentified needs and the older adults in the region, and reflect on what can be done about these issues.

Looking forward, GeriCaRe is planning to organise further research in the psychosocial aspects of the older adults, and how to address those in resource scant situations. It will continue to encourage participation in research by the older people and will seek support from various organisations.

Panini Samman, 2025

GeriCaRe confers the Panini Samman to individuals for their outstanding work supporting the care of older adults in various aspects and their lifetime contribution towards improving the health and sociocultural milieu of the population.

Panini was a sage between 6th and 4th BCE. He is famous for writing the Astadhyayi, which is a comprehensive and systematic grammar of the Sanskrit language. He developed a scientific approach to the grammar, described as almost mathematical, with nearly 4000 rules (sutras). His methods and work have had a profound and lasting impact globally. GeriCaRe considers that the Panini Samman Awardees have a comprehensive and systematic approach to the work they are doing, which has a profound impact on their communities and which will continue to inspire people for ages.

For 2025, Shri Lokanath Sarangi received the Panini Samman on 12th October 2025. He is well-known for his work in the Planning and Convergence Department of the State Government, and as a compassionate and philanthropic individual. He is supporting various non-governmental organisations, promoting educational opportunities for the disadvantaged communities. The Award function was attended by individuals from India and the UK, was and addressed by Prof Nilamadhab Kar, Dr Sasmita Upadhyaya, Sri Banshidhar Mahapatra, Prof Rabi Narayan Subudhi, and Prof Namita Rath.

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Manuscript Preparation

Instructions for authors

Introduction

The *Journal of Geriatric Care and Research (JGCR)* (ISSN 2397-5628) is the official publication of Geriatric Care and Research Organisation (GeriCaRe).

Aims and scope

JGCR publishes articles from all fields relevant to old age, with an objective of encouraging evidence based practice in the care of elderly and to share information about good practice.

It is a multidisciplinary, peer-reviewed, scholarly journal covering diverse areas such as geriatric medicine, psychiatry, neurology, nursing care, end of life care, public health and related fields like gerontology, sociology, psychology, culture and law along with Allied Health Sciences like occupational therapy and physiotherapy, etc. Examples of broad areas covered by the journal are: Care and intervention for various specific conditions, disorders or disabilities, standards of care, examples of good practice, end-of-life care, elder abuse and its prevention, legal aspects relevant to old age and support; cultural and ethical issues associated with care, etc. Its readership includes not only the professionals in these fields but also older persons and their caregivers.

Besides regular issues, theme based special issues focusing one aspect of care are also published periodically.

Editorial process

The *JGCR* follows in principle the Recommendations for the Conduct, Reporting, Editing and Publication of Scholarly Work in Medical Journals by the International Committee of Medical Journal Editors (ICMJE) and the Committee on Publication Ethics (COPE).

Contributions for *JGCR* are accepted for publication on the condition that their substance (whole or part) has not been published or submitted for publication elsewhere, including internet. If there are other papers from same database, then the authors must send all details of previous or simultaneous submissions.

All submitted articles are peer reviewed. At the first step, the articles are assessed by the editorial board for its suitability for the formal review.

If found suitable, the manuscripts undergo a double-blind peer review. The suggestions received from reviewers are conveyed to the corresponding author. When appropriate, the author is requested to provide a point by point response to reviewers' comments and submit a revised version of the manuscript.

Manuscripts accepted for publication are copy-edited to improve readability and to ensure conformity with *JGCR* style.

Authorship

Authorship credit should be based only on substantial contribution to:

- Conception and design, or analysis and interpretation of data
- Drafting the article or revising it critically for important intellectual content, and
- Final approval of the version to be published

All these conditions must be met. Participation solely in the collection of data or the acquisition of funding does not justify authorship. In addition, the corresponding author must ensure that there is no one else who fulfils the criteria but has not been included as an author.

Group authorship is permitted, but in this case individual authors will not be cited personally.

If a professional medical writer was used for manuscript preparation, their name and contact details must be given in the acknowledgement and any conflicts of interest must be disclosed.

The corresponding author must sign the contributors form on behalf of all the authors, once a manuscript has been accepted. This author must take responsibility for keeping all other named authors informed of the paper's progress.

Unless otherwise stated corresponding author will be considered as the guarantor of the article. However one or more authors/contributors can be guarantor. The guarantor accepts full responsibility for the work and/or the conduct of the study, had access to the data, and controlled the decision to publish.

Declaration of competing interest

All submissions to the *JGCR* (including editorials and letters to the Editor) require a declaration of competing interest. This should list fees and grants from, employment by, consultancy for, shared ownership in, or any close relationship with, at any time over the preceding three years, an organisation whose interests may be affected by the publication of the paper.

Ethics approval of research

The *JGCR* expects authors to follow the [World Association's Declaration of Helsinki](#) and base their article on researches conducted in a way that is morally and ethically acceptable. The research protocol must have been approved by a locally appointed ethics committee or institutional review board.

Every research article must include a statement that the investigators obtained ethical approval for the study (or an explanation of why ethical approval was not needed) in the methods section of the manuscript with the name and location of the approving ethics committee(s).

Patient consent and confidentiality

A statement regarding informed consent must be included in the methodology. Studies involving humans must have written informed consent from the patients. Where the individual is not able to give informed consent for lack of mental capacity, it should be obtained from a relative (ideally next of kin), legal representative or other authorised person. If the patient is dead, the authors should seek permission from a relative (ideally next of kin), legal representative (usually next of kin) or other authorised person as a matter of medical ethics. If consent cannot be obtained, the head of medical team/hospital or legal team of the authors' institute must take responsibility that exhaustive attempts have been made to contact the family and that the paper has been sufficiently anonymised not to cause harm to the patient's family. Anonymisation means that neither the patient nor anyone could identify the patient with certainty. Such anonymisation might, at an extreme, involve making the authors of the article anonymous.

The authors should check the specific laws in their country. Contributors should be aware of the risk of complaint by individuals in respect of breach of confidentiality and defamation; and must archive the signed informed consent form.

The process used to assess the subject's capacity to give informed consent and safeguards included in the study design for protection of human subjects should be mentioned.

Publication Ethics

Authors should consider all ethical issues relevant to publication. This includes (but not restricted to) avoiding multiple submission, plagiarism and manipulation of figures/data. Any concerns in this regard must be brought

to the attention of the Editor and these will be investigated by procedures recommended by the Committee on Publication Ethics (COPE). If conclusive evidence of misconduct is found, the *JGCR* undertakes to publish a correction or retraction of article as necessary.

Clinical trial registration

All clinical trials must be registered in a public trials registry. This is a requirement for publications of the trials.

Qualitative research

The *JGCR* welcomes submissions of reports of qualitative research relevant to the scope of the care of elderly.

Article submission

Manuscripts for publication are submitted via email <jgcr.gericare@gmail.com>.

The *JGCR* is not responsible for statements made by authors. Material in the *JGCR* does not necessarily reflect the views of the Editors or of GeriCaRe.

Type of manuscripts

Research article

The research article should normally be between 3000 and 4000 words in length (excluding references, tables and figure legends). Only the essential references should be given, preferably not more than 25 beyond those describing statistical procedures, psychometric instruments and diagnostic guidelines used in the study. Authors are encouraged to present key data within smaller tables in the appropriate places in the running text. This applies also to review articles and short reports.

A structured abstract not normally exceeding 150 words should be given at the beginning of the article, incorporating the following headings: **Background, Aims, Method, Results, and Conclusions.**

Key words: Up to six key words should be provided. Please use Medical Subject Headings (**MeSH**) as key words.

Article should have **Introduction, Method, Results and Discussion** sections. Authors may use relevant subheadings under these sections. Introductions should normally be no more than one paragraph; longer ones may be allowed for new and unusual subjects. The Discussion should always include limitations of the paper to ensure balance. A paragraph of practical implications of the observations is encouraged.

Short report

Short reports (brief communications) are based on original research, observational or evaluation studies, clinical audits etc. These are structured as research

articles and require an unstructured abstract of one paragraph, not exceeding 100 words; and key words. The report should not exceed 1500 words (excluding references, tables and figure legends) and contain no more than one figure or table and up to 10 essential references beyond those describing statistical procedures, psychometric instruments and diagnostic guidelines used in the study.

Case report

Case reports and series require up to unstructured 100 word abstract, and the length should not exceed 1000 words (excluding references, tables and figure legends). The written informed consent of the individuals must be obtained and submitted with the manuscript. Please refer to patient consent and confidentiality paragraph for further detail. In general, case studies are published in the *JGCR* only if the authors can present evidence that the case report is of fundamental significance and it is unlikely that the scientific value of the communication could be achieved using any other methodology.

Review

Systematic and narrative review articles should be structured in the same way as research article, but the length of these may vary considerably, as will the number of references. It requires a structured abstract like that of research articles.

Short review

These articles focus on highly topical issues based on evidence. Professional perspectives, viewpoints, commentary and opinion are included here. It can also include clinical review relevant to the practitioners. These articles are usually more broad-based than editorials. They can include tables and figures. Usual length is around 1500 words (excluding references) with an unstructured abstract up to 100 words.

Editorial

Editorials require an unstructured summary of one paragraph, not exceeding 50 words. Editorials should not exceed 1000 words and may contain no more than one figure or table and up to 10 essential references.

Letters to the Editor

Letters may be submitted either as responses to published articles, to inform about particular situation or raise pertinent issues, as expert opinion or as general letters to the Editor. Letters may be up to 400 words in length with a maximum of 5 references.

Insight

These articles include variety of topics which may reflect an individual perception, involvement or contribution to geriatric care. It can include good practice examples, inspirational experiences and highlight neglected areas. Essays in descriptive prose can be submitted on any topic related to geriatric care. These are usually written by a single author but a second author may be included occasionally. The length of the articles may vary considerably depending upon the topic and may be up to

2000 words excluding references. An unstructured summary of around 100 words is preferred but not mandatory. Use of subheadings is encouraged.

First person account

In first person accounts *JGCR* publishes experiences of older persons or their care providers about the care and concerns of the elderly, that can be considered significant and provide learning points for others.

Columns

These comprise a range of materials considered to be of interest to readers of the *JGCR*. This section includes reviews on book, film or web resources as short articles up to 400 words. Some other examples include News regarding developments that can influence the care of elderly, poems, paintings, photographs, quotations, information about important internet links, etc. These articles are published individually or as fillers at the end of other articles where space allows.

Preparation of Manuscripts

Prepare article in Word, A4 size page, with 1 inch margin, double spaced throughout.

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9. Number of tables: (total number of tables and figures should not be more than 10, preferably less than 5.)
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12. Competing interests:
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The article text pages do not contain any identifiable information, for a blind review. It should contain: Title of the article, Abstract and Key words (depending upon the article type) and the Text of the article. Please refer to article types for detail information. As a general rule,

please have an Introduction and Conclusion subheadings whenever possible along with other required subheadings.

References

Authors are responsible for checking all references for accuracy and relevance in advance of submission. All references should be given in superscripted number in the order they appear in the text. Place superscript reference number after commas and full stops, unless the superscript is attached to authors name or title of book/database. At the end of the article the full list of references should follow the **ICMJE style**. If there are more than six authors, the first six should be named, followed by 'et al'.

Example of journal articles:

The authors' names are followed by the full title of the article; the journal title abbreviated according to the PubMed; the year of publication; the volume number; (issue number in bracket); and the first and last page numbers:

1. Singh SP, Singh V, Kar N, Chan K. Efficacy of antidepressants in treating the negative symptoms of chronic schizophrenia: meta-analysis. *Br J Psychiatry*. 2010; 197(3): 174-9.

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2. Murray PR, Rosenthal KS, Kobayashi GS, Pfaller MA. *Medical microbiology*. 4th ed. St. Louis: Mosby; 2002.

3. Meltzer PS, Kallioniemi A, Trent JM. Chromosome alterations in human solid tumors. In: Vogelstein B, Kinzler KW, editors. *The genetic basis of human cancer*. New York: McGraw-Hill; 2002. p. 93-113.

4. Foley KM, Gelband H, editors. *Improving palliative care for cancer* [Internet]. Washington: National Academy Press; 2001 [cited 2002 Jul 9]. Available from: <http://www.nap.edu/books/0309074029/html/>.

5. Cancer-Pain.org [Internet]. New York: Association of Cancer Online Resources, Inc.; c2000-01 [updated 2002 May 16; cited 2002 Jul 9]. Available from: <http://www.cancer-pain.org/>.

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Tables should be numbered and have an appropriate heading. The tables should be mentioned in the text such as Table 1 and the desired position in the manuscript should be indicated. Information in tables must not be duplicated in the text. The heading of the table, together

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Figures must be of high quality and provided in JPEG files separately. They should be clearly numbered and include an explanatory legend. Legends can be provided at the end of the article after the references. All figures should be mentioned in the text (such as Fig 1) and the desired position of the figure in the manuscript should be indicated. Authors must obtain written permission from the original publisher if they intend to use figures from other sources, and due acknowledgement should be made in the legend.

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All abbreviations must be spelt out on first usage and only widely recognized abbreviations will be permitted. Abbreviations usage should be consistent throughout the article. Use abbreviations sparingly; consider using one if it is repeated more than three times.

The generic names of drugs should be used.

Generally, SI units should be used; where they are not, the SI equivalent should be included in parentheses.

Footnotes are not allowed, except table footnotes.

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GericaRe

GericaRe (Geriatric Care and Research Organisation) is involved in the care of the elderly and research in various aspects relevant to old age with an overarching aim of improving the quality of life of older adults. It endeavours to provide evidence based information for caregivers, elderly and the health care professionals about age related issues and to support life-long-learning through educational programmes for professionals and carers..

For its activities, GericaRe has received the Vayoshreshtha Samman, an Indian National Award in 2016 as the 'Best Institution for Research in the Field of Ageing' by the President of India.

Sharing knowledgebase and making the research evidence utilisable in the community is a key focus of GericaRe. It conducts and supports various research and development projects in various disciplines including health, psychology, sociology and other allied fields.

It prepares and distributes public education materials. Journal of Geriatric Care and Research (JGCR) is one of its flagship endeavours. The JGCR is free to readers and authors and is distributed worldwide.

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Preferably, please consider setting up a direct debit at least yearly (or more frequently if you wish) which will help GericaRe in planning its activities; however onetime payments are also welcome. For payment instructions or further information on donation, please contact org.gericare@gmail.com or jgcr.gericare@gmail.com.



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