Neurodegeneration, Fall Risk, and Emergency Department Care: Emerging Evidence

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Editorial

Neurodegenerative diseases such as Alzheimer's and Parkinson's are increasingly recognized as key contributors to fall risk among older adults. Falls are the leading cause of injury-related emergency visits among the elderly, and cognitive decline appears to play a bidirectional role in this relationship [1]. As one classic study noted, the presence of senile dementia of the Alzheimer type (SDAT) more than doubles the risk of serious falls compared to cognitively normal older adults. Likewise, recent research shows that even preclinical Alzheimer's-related changes (such as hippocampal atrophy and amyloid pathology) are associated with higher falls incidence [2], patients with dementia may experience up to eight times as many falls as those without cognitive impairment [3]. These observations underscore that patients with neurodegenerative disorders present a uniquely high fall risk in the emergency department (ED) setting.

In neurodegenerative disorders, several factors heighten fall propensity. Alzheimer's and other dementias impair judgment and mobility, while neurodegeneration disrupts networks critical for balance and autonomic control. Autopsy studies reveal degeneration in brainstem nuclei that regulate cardiovascular reflexes, and dementia patients commonly exhibit orthostatic hypotension and carotid sinus hypersensitivity. Motor syndromes also contribute: for example, Parkinson's disease causes bradykinesia, rigidity, and impaired balance, and autonomic failure (especially orthostatic hypotension) that compounds fall risk. In practice, older patients with known Parkinsonism or dementia frequently arrive at the ED after injuries caused by falls [4]. One large emergency medicine study found that injuries (often fractures or contusions from falls) were among the most common reasons Parkinson's patients presented to the ED. In sum, neurodegenerative pathology – from cortical deterioration to basal ganglia dysfunction – interacts with sensory and vascular changes to magnify fall risk, making ED visits for trauma and other injuries particularly prevalent in this population [5].

In the ED context, this interplay of cognitive impairment and trauma has important implications. Older ED patients often have undiagnosed neurocognitive deficits. Landmark work demonstrated that over a quarter of geriatric ED patients have mental status impairment, yet ED clinicians document it only rarely. Contemporary guidelines now emphasize routine cognitive and delirium screening in older ED patients [6]. For example, the American Geriatric ED consensus highlights that dementia and cognitive impairment are common but under-recognized in the ED, advocating structured screening to improve detection [7]. Such practice is critical because an "unrecognized" cognitive impairment may lead to unsafe assumptions about a patient's ability to follow discharge instructions or medication regimens [8]. In practice, falls may serve as a red flag: one large study found that an injurious fall was associated with a 21% higher risk of receiving a dementia diagnosis within the following year. This suggests that ED presentations for falls should prompt consideration of underlying neurodegeneration.

Fortunately, novel artificial intelligence (AI) tools are now emerging to aid ED clinicians in identifying neurodegenerative disease. Data-driven algorithms can flag at-risk individuals using information already collected in routine care. For example, an XG Boost model applied to electronic health

record data in an ED cohort predicted cognitive impairment (as measured by a quick orientation-memory test) with an area under the curve (AUC) of 0.72. In practical terms, this model could reduce the number of patients needing in-person cognitive screening while still capturing most of those with impairment. Another AI model analyzed multimodal brain imaging from thousands of patients and achieved high discrimination (AUC 0.82–0.94) among Alzheimer's, Lewy body, vascular, and other dementias. These results suggest that AI could one day augment ED workflows – for instance, by alerting providers when imaging or data patterns are suggestive of neurodegenerative pathology.

In the ED of the near future, one might imagine integrated AI decision support: algorithms that analyze trauma severity, lab results, and even speech or gait data to suggest a hidden diagnosis. Indeed, preliminary work is exploring voice and movement analysis using smartphones for Parkinson's detection. A recent review found that ML and deep-learning models applied to voice recordings achieved very high accuracy in distinguishing Parkinson's patients from controls [9]. However, these studies also highlight caution: most AI models are trained on small, homogeneous datasets, limiting generalizability. Key challenges include data heterogeneity and bias in training cohorts. Thus, while AI holds promise for earlier dementia or Parkinson's detection, deployment in ED settings will require large, diverse datasets and prospective validation.

Optimizing acute management for patients with established neurodegenerative disorders is essential. Emergency clinicians must modify standard care pathways, as patients with Parkinson's disease require timely dopaminergic therapy and are particularly sensitive to certain medications. Typical antipsychotics (e.g. haloperidol) can worsen parkinsonian motor symptoms and should generally be avoided [10]. Instead, when sedation or delirium treatment is needed, alternatives like dexmedetomidine or low-dose quetiapine may be safer [11]. Similarly, delirium superimposed on dementia is common: about one-quarter of hospitalized elderly present with delirium, and many dementia patients arrive with exacerbations of cognitive or behavioral symptoms. In practice, this means ED staff should engage caregivers early, minimize room changes and sensory disruptions, and involve geriatric or neurology consultants as needed.

When a patient with dementia presents after a fall, the ED workup should go beyond fracture repair: it should include medication review (e.g. checking antihypertensives or sedatives that could contribute to orthostatic risk) and consideration of underlying causes. Guidelines recommend that fall evaluation be multifactorial, addressing both the injury and the "geriatric syndrome" factors that predisposed to the fall. Recent geriatric-ED studies indicate that targeted fall-

risk screening programs can modestly reduce repeat falls. In one randomized trial, implementing comprehensive falls-risk assessment in an ED cohort reduced 30-day fall-related return visits (2.9% vs higher in control), albeit at the cost of longer ED stay [12]. These findings highlight the emergency department visit as a critical opportunity for prevention, including the identification of patients who may benefit from physical therapy referral, home safety evaluation, or timely outpatient cognitive assessment.

In summary, neurodegeneration and fall risk are closely intertwined in emergency care. Falls among older adults frequently signal underlying cognitive or motor impairment, and emergency visits for falls may represent an early manifestation of dementia or Parkinson's disease [13]. Accordingly, emergency clinicians should maintain a high index of suspicion for cognitive impairment in older patients presenting after a fall, apply established geriatric screening guidelines, and tailor management for individuals with known neurologic disorders using disease-specific precautions, such as appropriate medication management in Parkinson's disease and strategies for delirium prevention. Continued research and cross-disciplinary collaboration will be essential to refine risk stratification and care pathways [14]. Ultimately, recognizing the interconnections between falls, dementia, and Parkinson's disease may enable emergency clinicians to prevent recurrent injury, initiate earlier interventions, and improve outcomes for this complex and vulnerable population.

Conflict of Interest

There is no conflict of interest.

Author Contribution

Nikhil Pateria written and formulated the idea for the manuscript and Nikita Tiwari reviewed and edited the same.

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