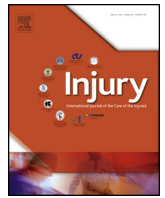




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## Dementia and fragility fractures: Issues and solutions

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### ABSTRACT

Dementia and fragility fractures are two conditions that pose significant morbidity and mortality to the elderly population. The occurrence of the 'gerontic' boom as a result of improved healthcare meant a continued increase in the prevalence of fragility fractures and dementia. This represents a major public health problem with significant socioeconomic repercussions. It is therefore important for healthcare professionals to gain a better understanding on the relationship between these two commonly co-existing conditions.

In this review, we present the available literature surrounding the relationship between fragility fractures and dementia, and the common challenges faced in the management of these two conditions. Combining evidence from the literature along with our current clinical practice, we propose a management pathway aimed at early diagnosis, prevention and management of these two often co-existing conditions. This alongside with a multidisciplinary approach will not only translate to improved patient outcomes and survivorship, but also reduced healthcare cost and socio-economic burden.

To date, there is insufficient evidence from the literature to suggest whether dementia is the cause or effect for fragility fractures, or if indeed there is a bidirectional relationship between the two conditions. Further studies are required to shed light onto this important clinical topic.

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### Introduction

Dementia and fragility fractures are two conditions commonly found in the elderly, especially in the oldest old. In the United Kingdom over the past decade, we begin to observe the 'gerontic boom' and 'octogenerian boom', with the population aged  $\geq 65$  and  $\geq 85$  increasing by 21% and 31% respectively since mid-2005 [1].

Dementia is a condition characterised by progressive deterioration in memory, impairment of cognitive function beyond that expected of normal ageing, behaviour, and inability to perform everyday activities [2]. Dementia should be viewed as a spectrum, commonly caused by Alzheimer's disease (60–80%), vascular dementia (15–37%), Lewy Body dementia (5–24%), and Parkinson's disease (3–4%) [3–5]. Worldwide, it is calculated that approximately 35.6 million individuals were found to suffer from

dementia in 2010 [6]. This number is expected to double every 20 years, and has been projected to reach 65.7 million in 2030 and 115.4 million in 2040 [6]. This is most likely explained by the occurrence of the 'gerontic boom' observed throughout the world as a result of better healthcare and quality of life in the developed world, thereby increasing life expectancy.

Osteoporosis on the other hand, represents a progressive musculoskeletal disease characterised by low bone mass and structural deterioration of bone architecture; consequently leading to increased bone fragility and susceptibility to fracture [7]. It is perhaps unsurprising that osteoporosis causes nine million fractures worldwide and this number is expected to exponentially increase in the following years [8]. The fractures occurring on the background of osteoporosis are commonly referred as fragility fractures. More specifically, fragility fractures are defined as fractures resulting from low energy trauma, such as fall from a standing height or less [9,10]. They most commonly involve the spine (wedge fractures), the proximal femur and the distal radius [7].

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**Table 1**  
Literature looking at relationship between fragility fractures and dementia.

Study/year	Sample size	Study design/assessed	Key findings/Result/recommendations
Weller et al. [27]	n = 1513	<ul style="list-style-type: none"> <li>Canadian study</li> <li>Study period 1994–1995</li> <li>examined association between Alzheimer's disease, hip fractures, and falls in elderly <math>\geq 65</math> years old</li> </ul>	<ul style="list-style-type: none"> <li>Independent relation between AD and hip fractures (OR 2.18, 95% CI: 1.26–3.79)</li> <li>OR relating AD to hip fractures was 1.78 (95% CI: 1.01–3.14), indicating a relation between AD and hip fractures that was independent of falling</li> </ul>
Friedman et al. [19]	–	<ul style="list-style-type: none"> <li>Review article</li> </ul>	<ul style="list-style-type: none"> <li>Proposed a pathogenic framework to explain relationship between dementia and fractures</li> </ul>
Bukata et al. [18]	–	<ul style="list-style-type: none"> <li>Review article</li> <li>Summarised the modifications in perioperative management and fracture fixation in patients with common fragility fractures with impaired bone quality.</li> <li>Also summarised post-operative diagnosis and treatment of secondary causes of impaired bone quality</li> </ul>	<ul style="list-style-type: none"> <li>Long-term diagnosis and treatment of secondary causes of poor bone quality (Vitamin D deficiency/insufficiency, hypothyroidism, hyperthyroidism, hyperparathyroidism, Cushing's disease, and hypogonadism) are important as secondary prevention against future fractures</li> </ul>
Zhao et al. [29]	–	<ul style="list-style-type: none"> <li>Meta-analysis of 9 studies</li> </ul>	<ul style="list-style-type: none"> <li>AD patients are at higher risk for hip fracture than healthy controls [OR and 95% CI fixed: Effect Size = 2.58, 95% CI = (2.03, 3.14)]</li> <li>Alzheimer's disease patients have lower hip BMD than healthy controls</li> </ul>
Gleason et al. [20]	n = 1070	<ul style="list-style-type: none"> <li>Case-control analysis of a database of all patients age <math>\geq 60</math> years admitted for surgical repair of non-pathological, low-impact femur fracture</li> <li>Study period: May 2005–October 2010</li> </ul>	<ul style="list-style-type: none"> <li>Patients with dementia were more likely to have a diagnosis of osteoporosis predating their fracture, compared to patients without dementia (43.8% vs 37.7%, <math>p &lt; 0.05</math>).</li> <li>However, dementia patients were not more likely to be treated for osteoporosis (despite being more likely to be diagnosed)</li> </ul>
Lai et al. [21]	n = 3744	<ul style="list-style-type: none"> <li>The relationship between AD and risk of hip fracture in older people in Taiwan</li> </ul>	<ul style="list-style-type: none"> <li>AD is associated with 2.4 times greater risk of hip fracture in older people in Taiwan</li> </ul>
Scandol et al. [23]	n = 44,143	<ul style="list-style-type: none"> <li>Study period: July 2000–June 2009</li> <li>Investigate prevalence of dementia within hip fracture patients</li> <li>Impact of dementia on hospitalisation LOS and survival</li> </ul>	<ul style="list-style-type: none"> <li>Dementia constitute up to 29% of the total population of elderly hip fracture patients in hospitals</li> <li>Patients with dementia has: <ul style="list-style-type: none"> <li>(i) Greater relative mortality rate (Overall HR of 2.4; 95% CI 2.3–2.6)</li> <li>(ii) Rate of discharge from the fracture-related hospitalisation was 40% greater</li> <li>(iii) Shorter LOS than those without dementia, but possibility due to early discharge to a residential age care facility or equivalent</li> </ul> </li> </ul>
Zapatero et al. [28]	n = 2,134,363	<ul style="list-style-type: none"> <li>Analyzed the incidence of hip fracture as a complication of admissions to internal medicine units in Spain</li> </ul>	<ul style="list-style-type: none"> <li>0.057% of in-hospital hip fracture.</li> <li>Higher in-hospital mortality (27.9% vs 9.4%; <math>p &lt; 0.001</math>)</li> <li>Significantly longer LOS in patients with hip fracture (20.7 days vs 9.8 days; <math>p &lt; 0.001</math>).</li> <li>Risk factors for fracture were dementia, female gender, admission from nursing home, malnutrition and anaemia.</li> <li>Higher healthcare cost in hip-fracture patients</li> </ul>

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