

# Dreadful Consequences of Sarcopenia and Osteoporosis due to COVID-19 Containment

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## Keywords

Osteoporosis, Sarcopenia, Fragility Fractures, Metabolic Bone disorders, Geriatric Trauma

The widespread implementation of lockdown, travel bans, quarantine, isolation, and social distancing due to the Coronavirus Disease 2019 (COVID-19) pandemic forces individuals to stay at home for extended periods. These restrictions have led people to adopt sedentary behavior, which is characterized by physical inactivity, poor dietary habits, and irregular sleep patterns that promote deterioration of muscle mass and function, loss of bone mineral density (BMD), and increase in body fat or adiposity. Moreover, lengthy hospitalization due to COVID-19 infection can result in a prolonged period of bed rest.<sup>1</sup> Such undesirable body composition is associated with various chronic, lifestyle-related, non-communicable diseases such as sarcopenia, osteoporosis, frailty, obesity, dyslipidemia, diabetes mellitus, hypertension, cardiovascular and cerebrovascular diseases, cognitive impairment, and depression.<sup>2,3</sup> These comorbidities put individuals at greater risk of contracting COVID-19 infection and developing a more severe course of disease with life-threatening complications.<sup>4-10</sup>

Sarcopenia and osteoporosis often termed as osteosarcopenia, are both age-related, progressive decline of the bone-muscle unit which causes are multifactorial, with the lack of physical activity and inappropriate nutrition playing pivotal roles. These conditions often coexist, primarily affecting the older population and are responsible for serious clinical, societal, social, and financial burdens. Genetic, developmental, paracrine, endocrine, and lifestyle factors have dual effects on bone-muscle mass and function. Sarcopenia is characterized by gradual and generalized wasting of muscle mass, strength, and quality or a loss of physical performance, whereas osteoporosis is described by low bone mass and microarchitectural damage to bone tissue resulting in increased bone fragility and vulnerability to fracture. While osteopenia and osteoporosis can be distinctly classified based on the BMD T-score, the staging for sarcopenia widely depends on the cut-off values on whole-body dual-energy X-ray absorptiometry (DEXA) scan of relative appendicular lean mass (RaLM).<sup>11,12</sup>

The alteration in lifestyle behavior due to COVID-19 containment measures result in the imbalance in muscle-bone unit synthesis and breakdown, leading to acute changes in body composition described as osteosarcopenic obesity. This unfavorable state promotes more oxidative stress and proinflammatory cytokines, exacerbating muscle dysfunction, impaired locomotion, bone deterioration, and increased long-term health risks as well as COVID-19 risk.<sup>1</sup> Bone loss was faster in osteosarcopenic compared to individuals with osteopenia or sarcopenia only.<sup>13</sup> The odds ratio of fracture was over 2 to 3 times higher in osteosarcopenic compared to those with normal BMD or normal muscle mass.<sup>14,15</sup> Also, the relative risk of fracture is higher among individuals with sarcopenia.<sup>12</sup>

In the age of COVID-19, musculoskeletal injury is on the lower list of clinical priorities, with many healthcare providers deferring or minimizing elective orthopedic services to make room for COVID-19 patients. Unfortunately, delays in managing emergency trauma or fracture cases, including seeking alternative or traditional treatments, can lead to catastrophic events such as osteomyelitis, soft tissue infection, compartment syndrome, delayed union, malunion, and nonunion.<sup>16</sup> This has broad implications for the care of patients with bone fragility, with more efforts should be deployed to prevent fragility fractures. Otherwise, a surge in fracture incidence and associated morbidity and mortality is expected in the near future.<sup>17</sup> During the COVID-19 period, the proportion of low-energy fall

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increased over 2 times compared to the pre-pandemic. This injury mostly found in the elderly, resulting in fragility fractures. Home-confinement contributed to a rise in the proportion of injuries that occur at home, which was almost 4 times higher during the current outbreak.<sup>18</sup>

Although the incidence of major traumas has decreased markedly since the start of COVID-19 outbreak, the rate of fragility hip fracture remains unaffected.<sup>19</sup> Osteoporosis, which is a highly preventable and treatable condition, is on the rise globally and it has a profound impact on the physical, psychological, as well as the financial status of individuals and their caregivers.<sup>17</sup> Osteoporotic hip fracture remains a leading cause of morbidity and mortality in the older population where this condition often causes functional disability with a 1-year mortality of 20%.<sup>20</sup> Concomitant COVID-19 infection substantially increased the risk of mortality in patients with hip fracture to around 36%.<sup>21</sup> This raises great concerns among the geriatric population, since they were among individuals at high-risk of contracting COVID-19 or experiencing osteoporotic fractures. Besides, it has been found that the 30-day mortality of fracture patients during the pandemic was up to 2 times higher than that observed in the pre-pandemic situation.<sup>18</sup>

The prevalence of sarcopenia was 37% among previously ambulatory, community-based hip fracture patients. Other than the DEXA scan, the use of anthropometry, grip strength, and self-reported mobility could be an alternative option for determining sarcopenia in postoperative hip fracture patients.<sup>22</sup> However, these assessments did not predict the change in mobility in the year after hip fracture.<sup>23</sup> Even though sarcopenia did not affect the 1-year mortality rate of patients with osteoporotic hip fracture, it significantly increased the risk of 5-year mortality. Both perioperative sarcopenia and osteoporosis affected the 5-year mortality rate.<sup>24</sup>

An osteoporotic fracture occurs in 1 in 3 men and 1 in 5 women throughout their lifetime with an estimated 5.8 million disability-adjusted life years (DALYs) are lost every year.<sup>25</sup> The risk of recurrent fracture and fracture-associated complications is greatest in the next 12 months after the initial osteoporotic fracture. Therefore, timely assessment and management to prevent further fracture are imperative. A multidisciplinary approach is recommended to guarantee not only adequate surgical treatment but also appropriate care after discharge through a Fracture Liaison Service (FLS). Under normal circumstances, clinical management of patients with suspected osteoporosis or fragility fractures is already complex and neglected. Since the beginning of the outbreak, routine bone density assessments, such as DEXA scan, are no longer feasible given the extensive restrictions related to COVID-19 and limitations on in-person medical appointment. This eventually increases reliance on the use of fracture risk calculators alone, such as Fracture Risk Assessment Tool (FRAX).<sup>17,20</sup>

Older people tend to have at least 1 comorbidity, which results in chronic, low-grade, systemic inflammation and increases the likelihood of experiencing cytokine storm when contracting COVID-19.<sup>10,26,27</sup> Sedentariness and/or immobilization accelerates the loss of muscle mass and strength as

well as depletion of bone density, which contribute to an increased risk of falls as well as COVID-19-related complications.<sup>2,21</sup> Frailty worsens the physical and mental health status which hinders the recovery and return to the independence of performing activities of daily living (ADLs) if it is ever achieved.<sup>4</sup> Furthermore, long-term glucocorticoid treatment increases the risk of fragility fracture and leads to steroid dependency.<sup>28</sup>

The continuity of care is not only a prerequisite for successful treatment but also crucial for maintaining patient safety for a particular treatment, such as bisphosphonates and denosumab. Joint guidance on osteoporosis management in the COVID-19 era have been introduced by a multi-stakeholder and international coalition convened by the American Society for Bone and Mineral Research (ASBMR).<sup>29</sup> The use of telehealth appointment instead of traditional visit is strongly advised to preserve the continuity of care, including access to rehabilitation while minimizing the risk of nosocomial transmission. This online-based, audiovisual guided session proved to be a cost-effective option and was not inferior to the conventional face-to-face appointment.<sup>30,31</sup> However, weighing the risks and benefits of escalating or alternating treatment will be challenging in the current climate.<sup>20</sup>

Patients with sarcopenia and bone fragility are encouraged to practice a physically active lifestyle, complemented with proper diet and nutrition as well as good sleep quality and stress management.<sup>1</sup> A multicomponent exercise, including aerobic, resistance, balance, and coordination training is advised to enhance their strength, balance, posture, gait, and ultimately reduce the risk of falls. These home-based exercise programs, under the supervision of medical expertise, are proven to be feasible and effective in improving the quality of life of the elderly.<sup>32</sup> Regular exercise, when practiced in moderation, is associated with better physical and psychological well-being, a boost in the immune system, and a lower risk of opportunistic infections.<sup>33</sup> A balanced diet consisting of sufficient amounts of proteins, calcium, and various micronutrients should not be underestimated.<sup>11</sup> Also, vitamin D supplementation should be recommended given the beneficial effects not only on the skeleton but also on muscle function, gait, and immunity in patients with COVID-19.<sup>17,34</sup>

During and after the COVID-19 crisis, more attention should be directed to the care of people with osteoporosis and sarcopenia, especially the susceptible elderly, to avoid a spike in fracture cases and a wave of non-communicable diseases in the coming years.<sup>3</sup> Healthcare workers are already overwhelmed by the increasing number of new COVID-19 cases, which pose a serious economic burden to the community. While mitigation approaches must be increasingly enforced to limit the spread of infection, prevention strategies through the practice of a physically active lifestyle and healthy, quality diet and appropriate management with continuity of care are considered to be substantial correctable factors in lowering morbidity and mortality associated with fragility fractures and chronic conditions.<sup>1</sup>

## Author Contributions

M.A.L. and A.A.K confirm being the only contributors of this work and have approved it for publication.

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