Is ankle strength as important as vitamin D status in helping to prevent falls in winter?

The study by Bird et al., published in this issue of Age and Ageing [1] adds a new dimension to the vitamin D and falls story. The study followed 88 community-dwelling men and women between 60 and 89 years of age, living in Tasmania (41.1°S). During 15 months of observation, they found that 25-hydroxyvitamin D [25(OH)D] followed a seasonal pattern, with the peak measurement lagging behind that of sunlight exposure by 1 month, as expected; but it also lagged behind the peak values for muscle strength and physical activity. They did not observe an association between 25(OH)D and muscle strength, which they suggest may be due to reaching sufficient 25(OH)D to maximise ankle strength before the peak in 25(OH)D, and that further increases in 25(OH)D would not produce additional benefit. They found that it was ankle strength rather than knee strength that was associated with an increased number of falls. Although the study was relatively small, the subjects were examined over five consecutive seasons; and the findings, if confirmed in other populations, could influence falls management programmes in the future. Up until now, improving lower limb strength has tended to focus on quadriceps strength [2]. Including exercises to improve ankle strength, which may have been neglected so far, could prove to be more effective in the preventative management of falls in older people. This is important, as falls that result in a fracture often lead to a rapid decline in independent living with increased morbidity, and in some cases premature death.

Maintaining a good vitamin D status in older age is also essential. Overall, the evidence from observational studies suggests that low vitamin D status may be associated with poorer muscle strength and function. For example, the NHANES data from older ambulatory adults (aged 60–90 years) showed a dramatic decrease in lower limb function as assessed by 2.4 m walk and sit-to-stand tests when circulating 25(OH)D, the accepted marker for vitamin D, was <40 nmol/l [3]. Similarly for over 65 year olds living in Amsterdam, low vitamin D status [25(OH)D <25 nmol/l] was associated with a greater prevalence of grip strength loss (>40%) although not appendicular muscle mass loss (defined as >3%) over 3 years [4]. However, observational evidence relating vitamin D status to muscle function could be confounded by exercise and ill health, as those in poorer health may not go outside and consequently would not be able to synthesise vitamin D from sunlight, which is the major source of vitamin D for most healthy individuals.

The Institute of Medicine examined relevant observational evidence, three systematic reviews, and additional evidence from two randomised controlled trials, during its comprehensive review of the effect of vitamin D on physical performance and falls [5]. It concluded that the observational studies provided some support of a link between vitamin D status and physical performance; and that the RCT data suggested a minimum of 800 IU vitamin D a day with or without calcium might be beneficial. However, the limited evidence available could not be used to establish a dose–response curve between vitamin D and physical function.

For falls, they concluded that the review evidence overall was inconsistent and for the two later RCT, one showed no effect [6] and the other found an increased risk of falls using a high once yearly dose of vitamin D [7]. They referred to the Sanders study [7] as emerging evidence of adverse effects of vitamin D on falls. It is possible that vitamin D might have improved muscle function so that individuals were able to increase their physical activity, which resulted in more falls [8]. The issue of falls is complex and although it is recognised that exercise regimens can reduce falls [9], walking training is not advised in individuals at high risk of falling as brisk walking may in fact contribute to more falls [10].

Seasonal variation in falls has been reported in some studies and not others; and where it has been observed, the higher number of falls in winter has been attributed to poorer weather [11]. In addition to possible environmental causes (e.g. slipping on ice), inferior dorsiflexion caused by muscle weakness of the anterior tibialis in older age may be compounded by poor circulation, which makes the extremities more susceptible to the cold causing numbness and reduced sensation. The increase in falls number may be in part due to low vitamin D status, since vitamin D is required for neuromuscular health: as illustrated in a study of ergocalciferol supplementation. This found that the treatment prevented falls in winter and spring, but not in summer and autumn when 25(OH)D would be higher through increased ultraviolet light exposure [12]. There is also the issue of parathyroid hormone (PTH) which has been shown to follow a seasonal pattern from cross-sectional data [13]. PTH could also be involved in the causal pathway that results in falls [14, 15]; and it appears to be PTH rather than 25(OH)D or other contributory factors that is associated with mortality in the frail elderly [16].
In this published study (Bird et al. ref), the estimate of seasonal change in 25(OH)D was modest (15% of 58.1 nmol/l would mean that the mean summer and autumn peak was 66.8 nmol/l). Other populations which suffer greater seasonal changes in 25(OH)D due to higher latitudinal position may be more adversely affected, and might benefit more from vitamin D supplementation. However, seasonality may not just be about vitamin D. Better weather means that adults are more physically active. The subjects in this study also showed increased physical activity during the same period that ankle strength increased, although the authors point out that this does not prove a causal relationship in an observational study.

If supported by larger studies involving other populations, and confirmed by randomised controlled trials, the findings open up other avenues of research. In this study the authors took the average of both leg measurements: this means that adults are more physically active. The subjects in this study also showed increased physical activity during the same period that ankle strength increased, although the authors point out that this does not prove a causal relationship in an observational study.

Advice to keep healthy and maintain a ‘break-free’ future in older age (www.nos.org.uk) continues to be to spend some time outside most days in spring and summer, taking care not to burn (to obtain sufficient sunlight to make vitamin D), combined with appropriate exercise and a healthy diet (to preserve muscle and function); with vitamin D supplements required for most older people to bring vitamin D intakes up recommended amounts.

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