Research Progress on Frailty in Elderly People with Osteoporosis in the Community

Shajie Hou[a], Xiaolan Guo[b],*

Shaanxi University of Chinese Medicine, Xianyang, 712046, Shaanxi, China
[a]523825767@qq.com, [b]1104307158@qq.com
*Corresponding author

Abstract: As the population ages, the incidence of frailty in community-dwelling older adults with osteoporosis increases. This article reviews the content, advantages and disadvantages of frailty assessment tools, and influencing factors for frail older with osteoporosis in community, with the aim to provide a reference for early identification of frailty in older adults in the community and intervention methods.

Keywords: Community; Osteoporosis; Frailty; Assessment tool; Nursing intervention

1. Introduction

According to the communiqué of the seventh census of China, it is known that the proportion of the population aged 60 years and above reached 18.7%, among which the proportion of the population aged 65 years and above reached 13.5%, and the aging of the population has become the norm in China. Both osteoporosis and frailty are ageing-related geriatric syndromes, and studies have shown that they share the same etiological mechanisms, and each mechanism interacts with the other. Thus increased risk of occurrence of osteoporosis and frailty. It is known that frail elderly people often coexist with chronic diseases, osteoporosis is the 3rd highest incidence among comorbid chronic diseases[1]. The older with frail and osteoporosis have greater the occurrence odds of adverse health outcomes such as falls, fractures, and disability[2]. This article reviews the assessment tools and interventions for frailty assessment in older adults with osteoporosis in the community, with the aim of providing a reference for standardizing the use and rationalizing the selection of relevant tools for the development of care measures for older adults with osteoporosis.

2. Frailty is closely related to osteoporosis in the elderly

Osteoporosis is a systemic disease of the skeletal system that is prevalent in the elderly, and according to studies, the prevalence of osteoporosis varies in different regions of China, with an overall prevalence of 37.7%[3]. Frailty refers to the decrease in the reserve function of body systems, the decrease in the emergency capacity to resist unexpected events, and the increase in the vulnerability of the organism as we age[4]. As aging continues to increase, the elderly frailty population continues to be huge, and about 50% of the elderly are the pre-frailty[5]. Osteoporosis is a degenerative disease of the elderly, which can slow down the body's gait, poor muscle strength, and easy fatigue, thus leading to a decrease in self-care ability and reduced mobility, making patients vulnerable to frailty[6]; moreover, patients with osteoporosis are afraid of activities due to the psychological fear of falling, thus reducing or even limiting daily exercise, resulting in weakened muscle strength and reduced balance, increasing the degree of frailty[7]. Meanwhile, the loss of muscle strength and mass quality during aging leads to changes in skeletal structure and decreases mineral density, resulting in a decrease in bone quality and an increased risk of fracture. The more severe the debilitation, the greater the likelihood of fracture[7]. Evidence from several studies shows that elderly patients with osteoporosis and frailty increases their risk of fracture, all-cause mortality, and hospital readmission[8-10], as well as increases health care costs and care needs[11], seriously threatening the quality of life and life expectancy. Therefore, early identification, assessment and management of frailty and intervention with effective measures are important to delay the reversal of the development of frailty, reduce the occurrence of adverse events, and reduce the medical burden on families and the country.

3. Assessment tools of frailty in older adults with osteoporosis in the community

Both nationally and internationally, the lack of a standardized assessment tool specifically for frail patients with osteoporosis, may be one reason why clinical practice is not universal. A frailty tool used in the community should be able to quickly identify physical health and intervene older adults who need increased health care management. Assessment tools can be divided into two types: single physical frailty assessment tools and multidimensional frailty assessment tools. The following are reported.

3.1. Single physical frailty assessment tools

3.1.1. Fried frailty phenotype (FFP)

FFP was proposed by Dr. Fried in 2001 based on the diagnostic criteria of frailty proposed by the American Cardiovascular Health Study[12],which defines frailty in 5 aspects, specifically decreased body mass, slowed gait speed, decreased grip strength, low activity, and fatigue within 1 year, those who meet more than 3 items can be diagnosed as frailty, 1 to 2 items are pre-frailty, and no clinical manifestations are diagnosed as debilitation. In 2018, Wei Yin[13] translated the FFP to form a Chinese version and assessed the risk of debilitation in 179 elderly inpatients, showing that the Cronbach's alpha coefficient was 0.826,and the internal consistency Kappa coefficient was 0.892. The scale is now widely used in clinical practice from and is the preferred tool by expert consensus. But there is no unified prescribed standard for the 5 indicators due to racial differences, and the FFP only assesses physical function tests from the physiological level, lacking psychological, environmental and social aspects. As age increases, older adults gradually experience cognitive decline, significant internal anxiety and depression, which can result in incomplete assessment. In addition, the screening process requires medical personnel to use objective tools to assess gait speed and grip strength, which can make it difficult to conduct large-scale screening in the community.

3.1.2. Frail scale

The scale was developed in 2008 by the International Task Force on Nutrition and Aging and a panel of experts based on the frailty phenotype and frailty index[14] and is used as a self-report screening tool for the frail elderly. The scale mainly includes 5 aspects of self-fatigue, endurance (whether one can go up one floor), walking ability (whether one can walk 100 meters), diseases suffered (whether more than 5), and decrease in body mass. And each item is scored 1, with 0 indicating no frailty, 1 to 2 being pre-frailty, and 3 and above being frailty, with prediction of falls, death, and development of disability. Jing Dong mei et al [15] used the Chinese version of the FRAIL scale to screen 210 elderly inpatients for frailty and remeasured the reliability of the scale, showing that the Chinese version of the FRAIL scale had a Cronbach's alpha coefficient of 0.705, with good internal consistency, and average structural validity, content validity, and validity scale validity (SF-36 as the validity scale, AUG=0.779). The scale is questionnaire-based, and can help stratify the population in comprehensive geriatric assessment (CGA) and identify specific targets for intervention. It is simple to use, and suitable for community outreach.

3.2. Multidimensional frailty assessment tools

3.2.1. Frailty index (FI)

The FI was developed by MITNITSKI[16]in 2001 and is based on the "cumulative health deficit" model, which includes symptoms, signs, psychological and psychiatric indicators of frailty. The FI is calculated by dividing the number of indicators of ill health by the total number of indicators assessed, and then determining the degree of frailty based on the threshold. Researchers can select their own indicators of health according to the purpose of the study, and therefore the number of indicators measured and the cut-off values vary [17]. The FI has a wide range of dimensions and is suitable for assessing the overall condition of a population with known health information. But it is relatively too tedious and time-consuming to collect indicators of ill health from all the assessed individuals in the process of community screening.

3.2.2. Tilburg frailty indicator (TFI)

TFI is a frailty self-screening scale developed by Gobbens[18] in 2010 for older adults in the community. The scale has two forms, which the first one contains 10 entries, mainly related to age, gender, income, and chronic disease content, and is less used at present; which the second form includes 3 dimensions, namely: physical frailty (8 entries), psychological frailty (4 entries), and social frailty (3 entries), with a total of 15 scored entries, each with a score of 1, using a dichotomous The TFI has been

shown to be a good predictor of health risks[19], hospitalization and disability [20]. Xi Xing [21] translated the TFI scale and measured it in 138 inpatients, and the results showed that the scale had good internal consistency (Cronbach's alpha coefficient of 0.686), structural validity (r=0.205-0.620), and predictive validity. The TFI is more in line with the shift in the bio-psycho-social medicine paradigm, and has the characteristics of simplicity and integration. And it is suitable for investigation of frailty in elderly patients with chronic diseases.

3.2.3. Comprehensive frailty assessment instrument (CFAI)

The CFAI is a self-screening scale developed by De Witte[22] in 2013 and it is the first time to incorporate the home environment into the assessment criteria. The CFAI has 23 items, divided into 4 dimensions: physical (4-12 points); psychological (5-20 points) and emotional (3-15 points). The social dimension consists of social relationship assessment (3-15 points) and social support (0-10 points); environmental debilitation (5-25 points). Wang Kun [23] retested the reliability of the Chinese CFAI scale and found good internal consistency (Cronbach's alpha coefficient of 0.837), and construct validity.

4. Interventions for frailty with osteoporosis

Frailty and osteoporosis share certain similar risk factors, such as advanced age, body mass index, nutritional status, exercise, and social support[24,25]. These risk factors can lead to increased levels of frailty and osteoporosis, so active interventions are needed to reduce the occurrence of osteoporosis and slow the progression of frailty.

4.1. Early identification of frailty

Early identification of frailty in older adults with osteoporosis is critical, because a person's health trajectory usually accelerates as frailty progresses and becomes increasingly difficult to reverse or slow. With frailty screening tools, early identification of older adults who are already frail as well as those who are in the pre-frail stage makes it easier to change health trajectories earlier and to choose more treatment options. With early frailty screening, it helps to identify targets for intervention and then targeted care to improve the health components of frailty. For example, some older adults who have difficulty completing activities of daily living may need physical activity to improve their functional status.

4.2. Exercise and sports

Exercise is considered to be the current preferred option for the prevention and treatment of frailty syndromes [26], and guidelines [27] recommend exercise as one of the modalities of daily life.

Resistance exercise is a weight training method against resistance, mainly choosing large muscle movements and multi-joint exercises, while taking into account the balance of the body. It can increase the muscle load and accelerate the blood circulation of skeletal muscle, thus promoting the production of bone tissue and increasing bone density. Common resistance exercises include dumbbells, barbells, and elastic bands. Lai[28] conducted a 12-week lower extremity resistance exercise intervention in pre-frailty older adults and showed that the muscle strength level increased, while the physical fitness of the older patients improved compared to the previous one.

Aerobic exercise, such as walking, climbing, cycling, swimming, etc., and the exercise time is usually greater than 30 min. Walking is one of the typical aerobic exercises, which is often chosen because it is not controlled by the venue and time. Nie Mingjian[29] used four types of weight-bearing, self-weight, jumping and walking to train osteoporosis patients, and found that after 12 weeks, the bone density of femoral neck increased in all four groups compared with the control group (no exercise group), and the bone density of lumbar spine in the jumping group and walking group increased significantly compared with the control group, while the other two groups increased insignificantly.

Traditional exercise, as a unique sport in China, can improve balance and prevent falls by constantly shifting the center of gravity. Some studies have shown that tai chi training can significantly reduce the fall rate and improve static balance in older adults[30].

4.3. Nutritional support

The function of somatic organs of the elderly begins to decline, and malnutrition becomes increasingly prominent. A healthy and balanced dietary pattern is the basis for maintaining bone health

and preventing osteoporosis, as well as effectively delaying and reversing the process of frailty. Calcium is an important component of human bones, and vitamin D increases calcium absorption and improves muscle strength. Adequate protein helps maintain bone and muscle function and reduces the risk of osteoporotic fractures[31], higher animal protein intake may be beneficial in preventing frailty in older women[32], and Liao[33]found that protein supplementation combined with exercise promoted muscle mass and strength growth, effectively improving the frailty index.

4.4. Social support

Social support refers to the moral and material help and support from individuals and organizations such as family, relatives, friends, and colleagues. Social support serves as a buffer for the stress response and can cope with short-term challenges, stress and social relationship deprivation. According to a survey[34], patients' social support mainly comes from family members, and family members' attitudes and behaviors are the main influencing factors. Chen Changxiang[35] pointed out that good social support can provide material assurance for the treatment and rehabilitation of elderly frailty and promote the elderly to accept disease management actively. Social support should not only originate from family members, but also from community, group and self-support. Li Xing[36] found that team training and group supervision of exercises could help improve physical frailty, and that interaction with others could reduce anxiety and depression. In terms of social policies, social support measures such as public financial and collective subsidized income and type of health insurance have significant effects on the mental health of older adults and also contribute to the alleviation of social debilitation in older adults[37].

4.5. Health education

Health literacy is an individual's ability to acquire, understand, and use health information to form normative health behaviors, including disease prevention, self-care, and emergency medical treatment. A Meta-analysis pointed out that low health literacy may lead to an increased risk of death [38]. Health education is an important tool to improve the health literacy of the population. Studies have shown that community outreach is the main means of disseminating knowledge about osteoporosis[39]. By acquiring more knowledge about osteoporosis and frailty, the elderly people may improve treatment awareness and patients' compliance.

5. Conclusion

Both osteoporosis and frailty are positively related to age, and the onset and progression of frailty is a dynamic and reversible process. It can reduce or delay the progression of frailty by early identification of frailty. Currently, there is no uniform standard for frailty assessment tools for patients with osteoporosis. And the content of related assessment tools varies, as does the degree of prediction of disease risk. The single physical assessment tools, FFP and FRAIL, are not sufficient to reflect the comprehensive level of frailty in the elderly, but can be used as a basic screening method for outpatient frailty. FI has too many dimensions and different standards, and is cumbersome for researchers to use in community. The TFI and CFAI are two self-reported frailty screening tools, which are simple to use and have clear entries, and are more suitable for self-assessment of the elderly. It is suggested that a scale for screening frailty in osteoporosis patients can be developed for clinical research in the future. Home care is the most important way of aging in China, so primary health care institutions, especially community hospitals, should use appropriate assessment tools to identify frail and pre-frail elderly at an early stage. And it is also necessary to pay attention to improve the health literacy of elderly in the community and take comprehensive measures to delay the development of frailty.

Acknowledgement

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