

Importance of raising awareness about spontaneous insufficiency fractures in the bedridden elderly

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KEYWORDS: bedridden ■ immobility ■ insufficiency fracture ■ osteoporosis ■ stress fracture

With the elderly population growing, the number of osteoporotic fractures worldwide is projected to rise by approximately 50% over current figures by 2025 [1]. Hip fracture incidence continues to increase in some countries, including Japan, but increased diagnostic efforts and enhanced use of antiosteoporotic medications show signs of resulting in a true decline in the number of hip fractures in Canada and Europe.

In ambulatory elderly subjects, spontaneous insufficient hip fractures are likely to be the cause of a fall rather than the result. Spontaneous insufficient fractures are suspected in 24% of patients hospitalized after falling with femoral neck fracture and two-thirds of these patients had a history of pre-fall hip pain [2].

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Insufficiency fracture is a subgroup of stress fracture caused by normal or physiologic stress upon weakened bone, and occurs when the elastic resistance of a bone is inadequate to withstand normal activity. Sites most frequently affected are the sacrum, tibia, fibula, hip, vertebra and calcaneus, but this type of fracture can occur at virtually any skeletal site. Spontaneous insufficiency fractures appear most frequently in patients with rheumatoid arthritis, prolonged corticosteroid therapy, pelvic irradiation, bone metastasis, multiple myeloma and Paget's disease. However, the most common cause of insufficiency fracture is postmenopausal osteoporosis, mainly in the institutionalized elderly with prolonged history of immobility. Awareness is therefore heightened concerning occurrence of such fractures among the bedridden elderly.

Because spontaneous insufficiency fracture is difficult to detect by ordinary radiographic

imaging, systematic assessments of prevalence and outcome of such fracture have not been carried out. Most cases are reported as case series reports, with only a few epidemiological studies conducted to date. Yearly incidence of insufficiency fractures in the institutionalized elderly was reported to be approximately 0.84 per 100 patients [3]. In Japan, an observational study was conducted during 1998–2004 of patients in a long-term care facility. During the 6-year follow-up period, 18 patients, or 3.6% of 500 bedridden patients, suffered spontaneous insufficiency fracture. Fracture sites were femur (12), humerus (five) and proximal phalanx (one). All insufficiency fractures occurred near joint contractures [4]. A 30-month prospective observation cohort study in France was conducted among nursing home residents aged 65 years and older. Prevalence of long bone insufficiency fracture was 1% among patients admitted to a long-term nursing home. Overall mortality after fracture at 2 months was 24%, with the poorest outcome observed in the shaft fracture group, which showed mortality of 54% at two months [5].

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Sacral insufficiency fracture presents as non-specific pelvic or low back pain. Findings from a plain radiograph of the pelvis are often normal and diagnosis of the fracture is often delayed or overlooked. An MRI scan is effective at detection of insufficiency fractures, soft-tissue edema and marrow changes, and thus may provide an alternative to diagnosis with bone scintigraphy or CT scan. According to a case report evaluating mortality and functional outcomes after pelvic insufficiency fractures among elderly patients with a mean age of 83 ± 7.1 years over a 10-year



Saeko Fujiwara

Department of Clinical Studies,
 Radiation Effects Research
 Foundation, Japan

follow-up period, 50% of patients had not recovered their former level of self-sufficiency and 25% had to be institutionalized. The 1-year mortality in the study was 14.3% [6].

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With increasing life-expectancy, the number of fragile elderly has risen. In Japan, approximately 1.5% of elderly people aged 65 years and older were reported to be bedridden. Debilitated and bedridden elderly people are the most vulnerable to minor trauma leading to insufficiency fracture. It is clear that weightless environments due to prolonged bed rest have been shown to increase bone resorption and decrease bone formation, leading to increase in urinary calcium excretion. A study investigating bone loss among those placed at horizontal bed rest for a period of 17 weeks demonstrated that percentage changes from baseline were 4.6, 3.6 and 3.9% for bone mineral density (BMD) at the trochanter, femoral neck and spine, respectively [7]. According to a test in which 25 male volunteers underwent 90-day 6° head-down tilted bed rest, proximal femoral BMD decreased continuously during the 90 days of the bed-rest period, reached a nadir at day 6 after cessation of the bed rest and remained low until day 90 of the stop of the bed rest. Decrease in BMD was 5% at day 60 from the baseline. Bone resorption markers increased by approximately 60% at days 30–90 of bed rest [8]. In this disuse osteoporosis, sudden increase in bone resorption was found with marked elevation of osteoclast number and bone formation was found to have decreased.

Weightlessness also leads to drastic weakening of muscle strength and muscle atrophy. Immobilization atrophy develops very quickly during the first days of muscle disuse. Muscle mass decreased 0.5–1% per day owing to prolonged bed rest or immobilization, and muscle strength decreased 50% at 3–5 weeks of bed rest [9]. Mechanical force, either in the form of gravity or muscular contraction, affects health of skeletal features: external architecture of the bone; inner architecture (e.g., trajectories of the cancellous bone); and quality of the bone itself as a biomaterial. Weightlessness thus directly affects both bone quality and mass through muscle atrophy and weakness.

Osteoporosis is an underdiagnosed disease at nursing facilities. While 70% of residents in such facilities are estimated to have osteoporosis, only 13% are diagnosed with and treated for the condition [10]. Osteoporotic fracture is one important cause of bedridden elderly. It is necessary to detect osteoporosis among ambulatory elderly in nursing facilities and to initiate early treatment. Prevention of osteoporotic fractures leads to reduced numbers of bedridden elderly. In addition, a preventive approach should be discussed with bedridden patients. Several drugs have been introduced to prevent the bone loss observed in disuse osteoporosis and bed rest-induced bone loss. For example, bisphosphonates, agents most extensively used to prevent fragility fractures, can reduce fracture risk by up to 50% with long-term safety and tolerability. The compounds are inhibitors of hydrolysis-resistant calcification and exhibit strong antiosteoclastic activity. In a 120-day bed-rest study performed in Russia, a 95% increase in trabecular osteoclasts was observed among the subjects without treatment with bisphosphonates, but trabecular osteoclasts decreased among treated subjects [11]. No reports exist regarding effectiveness of treatment with bisphosphonates for bedridden elderly to prevent insufficiency fracture, but treatment with bisphosphonates is already used extensively in paraplegic patients [12], long-term bedridden pediatric patients with cerebral palsy [13] and elderly men following stroke [14]. The study of paraplegic patients demonstrated that osteoclast number increased in the placebo group, but decreased in groups receiving bisphosphonate [12]. Treatment with bisphosphonates increased BMD and reduced hip fractures among disuse osteoporosis patients [13,14]. Treatment with bisphosphonates might therefore be effective in prevention of insufficiency fracture in bedridden elderly patients.

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Physicians generally pay attention to prevention of fragility fracture in the elderly, but not all physicians are aware that spontaneous insufficiency fracture can develop among the fragile elderly with osteoporosis. In nursing homes, immobility and related complications are major problems. Caregivers, physicians and nurses should be as aware of this possible complication of spontaneous insufficiency fracture as they are of bedsores, infections and organ failure, all of which can arise due to a state of debilitation.

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