

Strenuous walking exercise and spontaneous fracture of the femoral neck in the elderly

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ABSTRACT

Spontaneous fractures of the hip which developed after strenuous walking exercise in 8 elderly people are reported. All patients had Singh hip index 4 or below at the time of initial examination and walked from 8,000 to 10,000 steps per day. This presentation aims to arouse the attention of physicians, recreational sports coaches, and elderly people to the deleterious effects of strenuous walking exercise on bone, and it looks for an optimal level of walking exercise according to the elderly patient's bone quality. Walking exercise should be stopped immediately if pain in the hip develops and continues without relief for several days or more. The optimal walking frequency per day should be prescribed on the basis of the Singh index or T-score of BMD. If the BMD is 1/3 to 1/2 of normal, walking frequency should be adjusted to 1/3 to 1/2 of those of the normal adult with good bone quality.

Key words: fracture, fatigue, hip, walking exercise, elderly

INTRODUCTION

There are many reports regarding stress fractures of the hip following repeated strenuous exercise in the young,² while there are only a few reports about spontaneous hip fractures in elderly people.^{3,4,7} Furthermore, there have been no reports on the relationship between the walking exercise level and insufficiency fractures of the hips in the elderly,^{9,10} though walking exercises are frequently recommended as a method of bone build-up. Up to now strenuous daily walking exercise of 10,000 steps has been routinely prescribed for young people to maintain good bone quality,^{8,11} and it has also been practised without adjustment for elderly people although the method had no scientific basis.

The purpose of this paper is to report insufficiency fractures of the hip in elderly people due to strenuous walking exercise of over 8,000 steps per day. It serves to arouse the attention of physicians, recreational sports coaches and elderly people to the deleterious effect of strenuous walking exercise on bone, and to discuss the optimal level of walking exercise for elderly people according to their bone quality.

MATERIALS AND METHOD

Eight elderly patients, who were subjected to strenuous walking exercises and developed insufficiency fractures of the hip, are reported. They were 3 males and 5 females, ranging in age from 56 to 87 years. They had maintained a low level of daily activity before being subjected to the exercise program. All patients had Singh hip index 4 or below 4, and joined the walking exercise programs through the guidance of recreational sports coaches. They took 8,000 to 10,000 steps of daily walking with measuring gauge within a time ranging from 2 to 3 hours or in 2 to 3 divided stages per day. The first signs of fracture, groin and/or buttock pain, developed 4 to 8 weeks after initiation of the walking exercise. Diagnosis of the fracture was made at average 2 weeks (latest at 6 months) after development of symptoms.

Two patients had both hips fractured, and six had unilateral hip fractures (3 right; 3 left). Two had bone scans for early detection of the fracture, which suggested indirectly the presence of fractures of the femoral neck. In one case without radiological fracture high uptake was noted 2 weeks and 2 days after development of symptoms, while in another case initial X-rays disclosed a mid-cervical fracture which was also proven by bone scan. The latter case developed hip pain 5 weeks after initiation of walking exercise and was examined at 8 weeks after exercise. Three patients had no fracture treatment, because they did not accept surgery (Fig. 4). In one patient, symptoms subsided after withholding the exercise and

bed rest. One had osteosynthesis with multiple pinning, and 4 had hemiarthroplasties.

RESULTS

Surgery was refused by two patients with bilateral hip fractures, one patient with unilateral fracture, and one patient with positive bone scan who was completely relieved of clinical symptoms after sufficient rest in bed. Another patient having relatively good bone quality had a satisfactory result after osteosynthesis. Three patients who had hemiarthroplasty had good clinical outcomes.

ILLUSTRATIVE CASES

Case 1 (Fig. 1)

A 65 year-old woman developed left hip pain 4 weeks after initiation of walking exercise and visited the outpatient clinic 2 weeks after onset of symptoms. On simple hip radiograms no fracture was detected (Fig. 1A). However, a bone scan disclosed increased uptake in the left femoral neck, suggesting the presence of early stress fracture (Fig. 1b). Exercise was immediately withheld. Bed rest for one week and non-weight bearing crutch walking for another 2 weeks relieved the symptoms completely. 3000 to 5000 steps per day of walking exercise was prescribed for her, based on her BMD(60% of young adults).

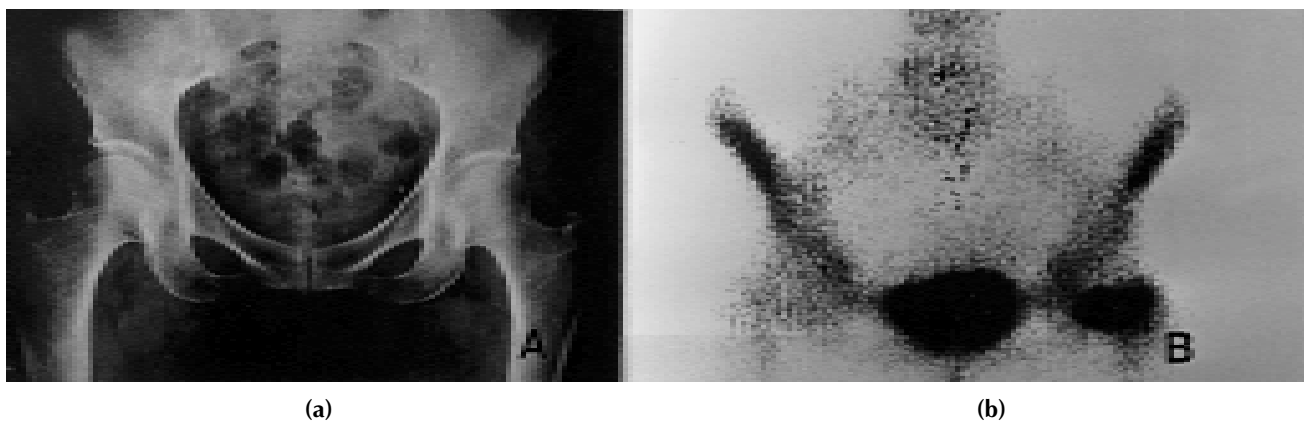


Figure 1 A hip radiogram and bone scintigram of a 65 year-old woman. No visible fracture line in the neck (a), while bone scan shows the increased isotope uptake over the left femoral neck area (b).

Case 2 (Fig. 2)

A 56 year-old man complained of left hip pain for approximately 8 weeks, which started 5 weeks after initiation of walking exercise of over 10,000 steps per day. Initial X-rays showed a fracture line in the mid-cervical level with reactive endosteal new bone formation together with increased isotope uptake in the same area. After diagnosis of the fracture, walking exercise was immediately withheld, and the fracture was treated successfully with multiple pinning because his bone quality was relatively good (Singh index : 4).

Case 3 (Fig. 3)

A 66 year-old woman suffered from mild left hip pain for 2 months, which developed 8 weeks after walking exercise. Three years ago she had radiotherapy after hysterectomy for the carcimoma of the cervix. Initial X-rays disclosed a displaced subcapital fracture for which Moore's hemiarthroplasty was performed, and she recovered fairly well.

Case 4 (Fig. 4)

An 87 year-old physician developed right hip pain 3 weeks after initiation of walking exercise. It was said that he prescribed the exercise program for himself and kept faithfully to a walking program of 8000 steps per day, because he had severe osteoporosis of spine with previous T12 fracture. Initial X-rays, taken 3 weeks after onset of symptoms, did not show any fracture line. However, X-rays taken 6 weeks after initial examination (12 weeks after initiation of exercise) showed displaced subcapital fracture. He refused surgery because of his age.

DISCUSSION

Fatigue fracture can occur in any bone, when those bones are subjected to any type of prolonged repeated stresses.^{3,4} According to Frankel,⁵ if half of the acute fracture violence of a certain bone is given repeatedly to a bone for a certain period of time, fatigue fracture

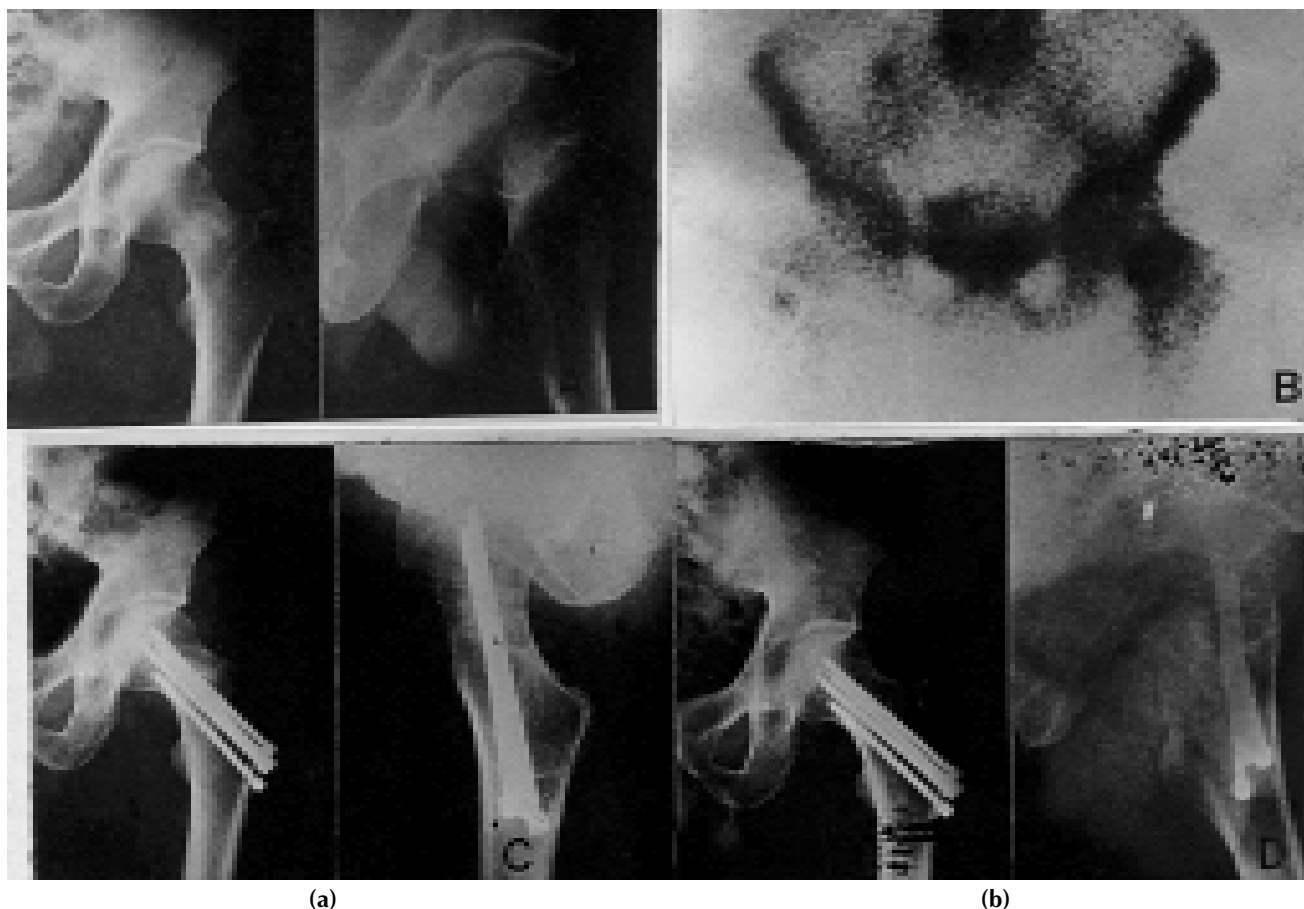


Figure 2 Initial radiograms (a) and bone scintigram (b) of the left hip in a 56 year-old man showing an undisplaced mid-cervical fracture, which was diagnosed 13 weeks after initiation of exercise. Osteosynthesis was performed with multiple pinning (c), and the fracture was well united when followed over a year (d).

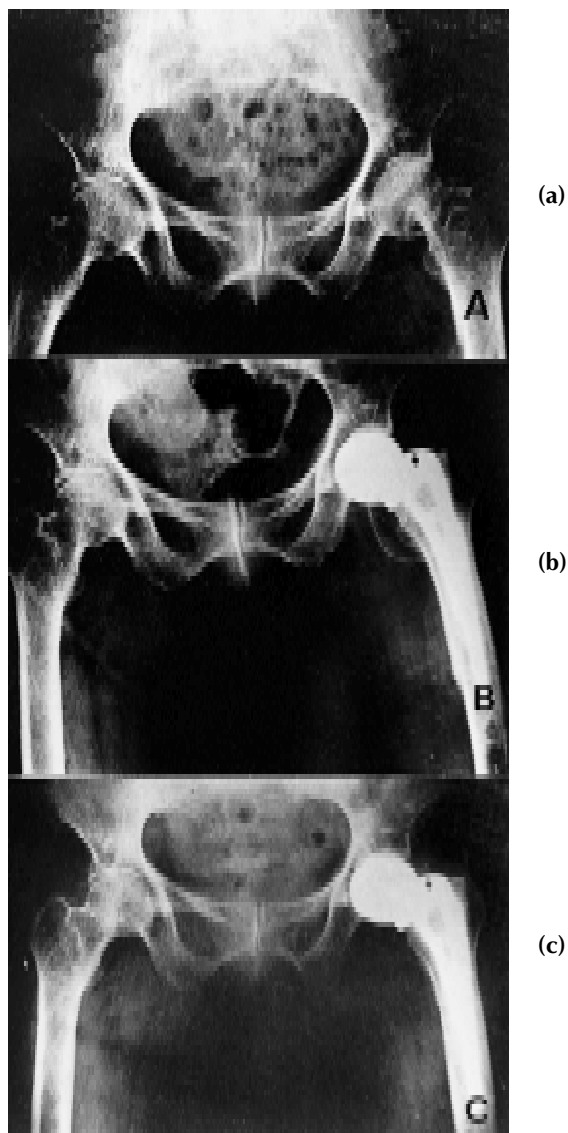


Figure 3 Initial hip radiogram (a) in a 66 year-old woman showed subcapital fracture of the left hip, which was treated with hemiarthroplasty (b) and was followed over one year with good clinical outcome (c).

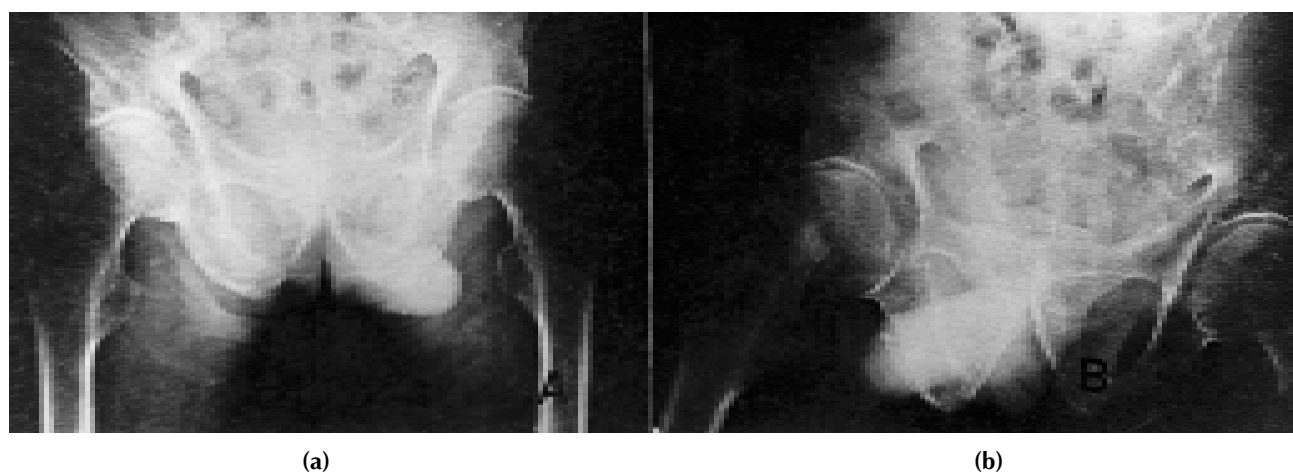


Figure 4 (a) Initial hip radiogram in an 87 year-old man, taken 6 weeks after initiation of exercise, showed no fracture line. (b) The second X-ray, taken 12 weeks after initiation of exercise, shows displaced subcapital fracture of the right hip.

can be induced. It is very important to remind physicians, recreational sports coaches and patients to avoid insufficiency fractures in osteoporotic bone through repeated stress.

Spontaneous fractures of the femoral neck can be divided into two distinct varieties. The first one is fatigue fracture which develops after prolonged strenuous physical activities in young adults with normal bone quality. The second type is insufficiency fracture in elderly people with osteoporosis, which can occur after moderate or far less repeated physical activities. Therefore, physicians should pay attention to the bone mineral density (BMD) of each patient, before prescribing the daily level of walking exercises.

The reported average daily frequency of walking in housewives and professional women is known to be 3000 steps and 7000 steps, respectively.^{8,11} It was stated by Watarai that former Japanese Imperial Army members walked 20 to 30 km continuously with a walking speed of 6 km per hour.¹² However, he did not mention the incidence of fatigue fractures in those soldiers.

5,000 steps of walking exercise in 40 minutes with 50% of maximum oxygen inspiration is prescribed to prevent hypertension. For normal young adults, over 10,000 steps of daily walking have been prescribed to maintain good bone quality. However, there has been no scientifically proven optimal level of walking for the elderly. The optimal walking frequency should be based on the Singh index or T-score of the BMD. If the bone mass is 1/3 to 1/2 of a normal person, the frequency of walking should also be 1/3 to 1/2 of normal. Gradual increase of the walking exercise up to the prescribed level is preferred to accommodate

increase in the endurance of muscle. If hip pain develops at any time during the walking exercise, it should be stopped and the hip should be carefully examined physically and radiologically to detect any possible hip fracture or infraction. This may become evident only on a bone scan, which is necessary in case of doubt.⁶

For prophylaxis of spontaneous fracture of hips, prior to prescription of walking exercise (speed and frequency), Singh index and BMD should be measured. Based on the Singh index and/or BMD, a tolerable level of walking exercise should be prescribed. In addition to walking exercise, medical treatment should be preferably combined. Exercise is not the sole solution for osteoporosis, and it sometimes brings about a harmful effect on porotic bone by inducing insufficiency fracture. We must refrain from indiscriminately counselling individuals to undertake programs of exercise with the hope of preventing osteoporosis.

Early insufficiency fracture with positive bone scan but negative radiographic findings should be treated conservatively by immediate cessation of walking exercise and bed rest or non-weight bearing crutch walking under strict supervision. Repeated roentgenographic examination is strongly recommended.

As regards the fracture treatment in elderly people, primary osteosynthesis is the most preferable procedure for the undisplaced fracture with relatively good bone quality, while hip replacement surgery is preferable for the displaced fracture with severe osteoporosis.

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