RESEARCH STUDIES

DOI: 10.5281/zenodo.1050980
UDC: 616.718.42-001.5:616.831-005.1

Femoral neck fractures in patients with stroke sequelae

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Abstract

Background: Patients with stroke associate a lot of complications; one of the most serious is femoral neck fracture. Nearly 30% of patients who have suffered femoral neck fracture die during the first year, in the survivors persists pronounced pain syndrome and reduced motility in the affected limb, and they become dependent in their habitual activities.
Material and methods: The notes of all patients with fractured neck of femur who were admitted to Clinical Hospital of Traumatology and Orthopedics, Chisinau, the Republic of Moldova, between January 2014 and December 2015 were scrutinized.
Results: In a series of 67 hemiplegic patients who subsequently fractured their hips, it was found that hip fracture occurred significantly more often on the hemiplegic side. Hip fracture was equally common in right and left-sided hemiplegia, and often occurred within five years of the stroke.
Conclusions: Hip fracture after stroke is an increasingly recognized problem. Measures to prevent bone loss and preserve bone architecture have not been part of stroke management thus far. Because rapid bone loss is a risk factor for fracture, we believe that kinesiotherapy in the early phase of stroke rehabilitation is indicated. If a successful prevention program could be worked out in stroke patients, there would be potential saving of lives, suffering, and resources.

Key words: stroke, femoral neck fracture, osteoporosis.

Introduction

Increased fracture risk is a recognized complication following stroke. Bone loss following a hemiplegic stroke has been proposed as a major risk factor for post-stroke hip fracture, with a recent focus on the development of novel therapeutic measures to prevent bone loss and fractures after stroke [10]. Stroke is a major cause of mortality and morbidity in elderly people. Information on the prevalence of stroke is difficult to obtain. However, it is expected to increase, because the incidence of stroke increases extensively with age and because survival after stroke is prolonged. Some of the risk factors for stroke, such as age and smoking, and for complications after stroke, such as paresis and immobility, are also well-known risk factors for osteoporosis. Other symptoms after stroke, such as reduced balance and perceptual disturbances, increase the risk of falls, which are common in stroke patients. Accordingly, stroke patients would be expected to be at risk for both osteoporosis and falls and, consequently, for fractures [1, 2, 3].

Stroke patients have up to a 4-fold increased risk of hip fracture, and poststroke hip fracture occurs late after stroke (median is 30 months after stroke onset) and most often affects the paretic side. The increased incidence of fractures after stroke is partly due to loss of bone mass in the paretic extremities after stroke, hemiosteoporosis, which begins early after stroke and continues to progress for the first years after stroke onset. The reported prevalence of previous stroke among patients with hip fracture ranges from 3% to 19%, but the prevalence has been studied neither recently nor over time.

Both stroke and hip fracture are common in the elderly but little has been written about the coexistence of these problems [4]. It is recognized that hemiplegic patients fall more often than other elderly people [5] and that such falls may result in hip fracture [6], so hip fracture can be a late complication of hemiplegia. Moreover, there is aclinical impression that hip fracture usually or invariably occurs on the hemiplegic side [7]. In order to determine whether hip fracture is indeed more common on the affected side, and to ascertain the interval between stroke and fracture, 67 patients with a history of hemiplegia who subsequently fell and fractured their hips were studied.

Material and methods

The notes of all patients with fractured neck of femur who were admitted to Clinical Hospital of Traumatology and Orthopaedics, Chisinau, the Republic of Moldova, between January 2014 and December 2015 were scrutinized. The admission history was studied to see if a completed stroke had occurred before the fracture. The side of the hemiplegia and the fracture and the interval between the 2 episodes were noted. All fractures were confirmed by radiography, and all patients underwent surgery involving internal nail fixation, prosthetic replacement. A previous stroke was defined according to the definitions of the World Health Organization as an "acute neurologic dysfunction of vascular origin with

sudden or at least rapid occurrence of symptoms and signs corresponding to the involvement of focal areas in the brain," with symptoms lasting ≥24 hours. If the patient had suffered more than one stroke, the interval between the most recent stroke and the fracture was recorded. Patients were excluded if the fracture occurred before or at the same time as the stroke; if the patient had sustained bilateral strokes; and if the side of the stroke was not specified in the hospital notes.

Statistical analysis

Data were analysed by Microsoft Excel. We calculated average parameters, standard deviations; t-Student test was used for comparisons. A value of $p < 0.05$ was considered statistically significant.

Results

Evidence of previous hemiplegia was found in 67 patients. Four (6 %) of them had sustained 2 or more ischemic strokes. In 3 (4.5%) cases there were no residual signs of hemiplegia. There were 39 (58.2%) women and 28 (41.8%) men in the group of study. Mean age of patients was 67 ± 1,37 years (minimum 46 years, maximum 82 years), mean age of females was 68,8 ± 4,8 years and 60,8 ± 5,5 years for men. There was a significant difference in age between the men and women (p<0.001) (fig. 1).

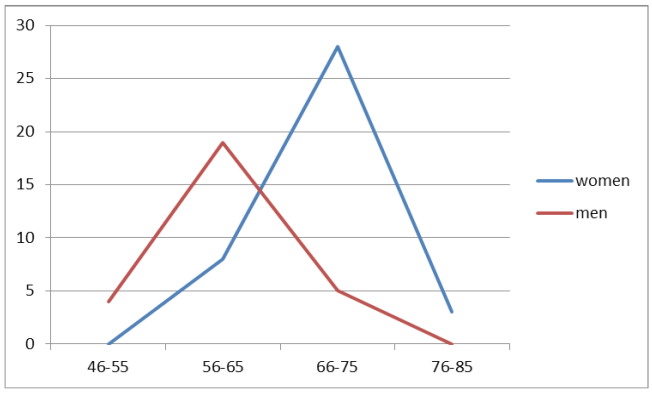

Fig. 1. Distribution on age.

All the women were aged 60 years or older, the majority (26 women, 67%) being in the 65-80 age range. Of the male patients, 6 (21.9%) were under 60 years, the youngest being 46 years old (tab. 1).

Table 1

The analysis variables in the group of study

	No	Mean age	The interval between stroke and fracture
Women	39 (58.2%)	68,8±4,8	4,3±2,8
Men	28 (41.8%)	60,8±5,5	4,9±3,5

Sixty four (95.5%) patients had sustained the fracture on the hemiplegic side, 3 (4,5%) on the opposite side (P<0.001). Patients with right and left sided hemiplegia were equally likely to sustain hip fractures (tab. 2).

Table 2

Side of hemiplegia and hip fracture

Side of hemiplegia	Side of hip fracture	No of patients
Right	Right	31 (46.5%)
Left	Left	2 (3%)
Right	Left	1 (1.5%)
Left	Right	33 (49%)

31 (46.3%) patients had sustained their fractures within 3 years of the stroke. The longest interval between stroke and fracture was 12 years (fig. 2). Only 2 patients fractured their hips within 6 months of the stroke. No patient was documented as having a stroke simultaneously with the fracture.

The prevalence of osteoporosis risk factors in the studied group was:

- Age: 65 patients (98.5%) were over 50 years,
- Gender: there were 39 women (58.2 %), all the women were over 50 years (100%),
- 11 smokers (16.4%) and 6 ex-smokers (8.9%) had been indentified, the average duration of the smoking cessation was 4 ± 1.36 years,
- 32 subjects were overweight (47.7%),
- 1 (1.5%) patient suffered from rheumatoid arthritis, and was on long-term glucocorticoid therapy
- 2 (2.9%) patients had neck fractures before.
- Heavy drinking was a preexisting risk factor to 6 (8.9%) of the subjects.

All patients underwent surgery involving internal nail fixation, prosthetic replacement.

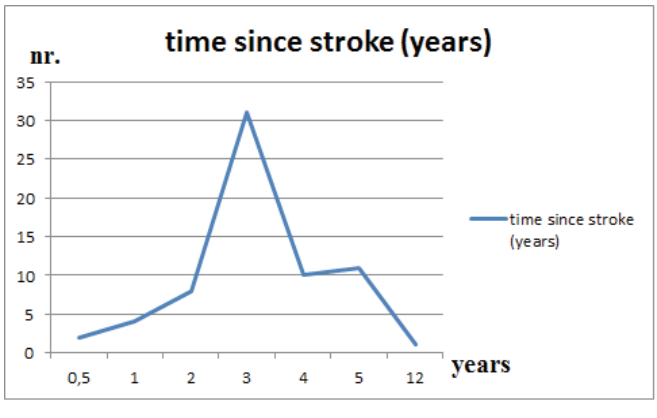

Fig. 2. Distribution by interval between stroke and fracture.

Discussion

In a series of 67 hemiplegic patients who subsequently fractured their hips, it was found that hip fracture occurred significantly more often on the hemiplegic side. Hip fracture was equally common in right and left-sided hemiplegia, and often occurred within five years of the stroke.

This study confirms the impression that hip fracture is significantly more common on the hemiplegic side. This may be because hemiplegic patients may tend to fall to the affected side [8], and the bone in the hemiplegic limb may be more

likely to break as a result of disuse osteoporosis [9].

There are many factors which contribute to the tendency of stroke patients to fall. These include sensory, motor, reflex and circulatory disorders [5]. Stroke may result in an upper motor neuron syndrome characterized by spasticity, muscle weakness, and a variety of motor control abnormalities that impair the regulation of voluntary movement. Spasticity may negatively affect balance, mobility, and gait, possibly increasing risk of falls and bone fractures. The problem is exacerbated by use of centrally sedating medications that have antispasticity effects-such as tranquilizers, calcium-channel blockers, and phenothiazines-but they predispose patients to an increased relative risk of falls when compared with patients not taking these medications. Appropriate management of spasticity is thus an important goal in the care of post-stroke patients, and may reduce incidence and cost of expensive and probably avoidable events such as falls and fractures. Spasticity is characterized by positive and negative symptoms. Positive symptoms include exaggerated reflexes, rigidity, dystonia, and flexor and extensor spasms that are often painful. Negative symptoms such as weakness, fatigue, and slow initiation of movement also occur. Contractures result when tonedependent joint restrictions on range of motion lead to deformity at the joint, requiring surgical intervention. Muscle weakness and loss of balance combined with hypertonia and other aspects of spasticity predispose patients to falls and fractures. According to the American Geriatrics Society Guideline for the Prevention of Falls in Older Persons, older patients with more than one factor predisposing them to fall are at a substantially increased risk for frequent falling. Generally, positive symptoms are more amenable to pharmacologic treatment than negative symptoms, but patients should have their medications reviewed as some agents have effects that may exacerbate fall risk.

There are some studies that show that patients with left-sided hemiplegia are particularly prone to perceptual disorders. They are less able to perceive verticality than are patients with right hemiplegia, they suffer, more commonly, from hemispatial neglect, also called hemiagnosia, which is a neuropsychological condition in which, after damage to the right hemisphere of the brain is sustained, a deficit in attention to and awareness of one side of space is observed [11, 12]. This study shows that right and left-sided hemiplegic stroke patients are equally likely to sustain hip fractures, which indicates that perceptual disorders are not important in the genesis of falls after stroke.

Changes in the locomotor function of the affected leg are believed to be responsible for most falls after stroke [5]. In patients with an equinovarus deformity of the ankle, the toe of the hemiparetic foot may catch the floor causing the patient to lose balance.

Patients with long-standing hemiplegia are known to develop disuse osteoporosis on the affected side. Literature data describe hemiplegic patients with unilateral osteoporosis who developed hip fractures on the affected side.

Several potential mechanisms contribute to bone mineral density loss after stroke, although there has been limited research into hemiplegia-induced bone loss at the cellular level [13]. A major factor is immobility, which contributes to generalized bone loss, in turn compounded by region-specific bone loss at sites such as the hemiplegic hip and upper limb.

Factors such as the duration of hemiplegia, degree of functional recovery, reduced vitamin D status and the use of anticoagulants [14, 15] may determine the rate and extent of bone loss after stroke. In a recently reported study of the changes in bone mineral density of the forearms and legs in relation to the duration of hemiplegia-induced immobilization after stroke, some studies confirmed that bone mineral density was decreased in the hemiplegic extremities relative to the unaffected side. They also found that there was an inverse relationship between duration of hemiplegia and bone mineral density values. In hemiplegic elderly patients with ischaemic stroke, hyperhomocysteinaemia has also been reported to be associated with hip fracture risk [16-30].

In the present study, only 2 patients sustained fractures in the first 6 months. In the early stages of recovery from stroke, one would expect those patients who had regained some mobility to be particularly prone to falls. The frequency of hip fracture in the first 6 months after stroke suggests that unilateral osteoporosis may be an important factor in the development of fractures in hemiplegic patients. Little is understood about osteoporosis in hemiplegic limbs. It would be interesting to know how commonly hemiplegic patients develop osteoporosis,how soon after stroke it occurs, and whether disuse osteoporosis is related to spasticity or weight-bearing.

The incidence of hip fracture after stroke is uncertain. Peszczynski in 1957 found that 23 of 150 patients attending a rehabilitation centre after hip fracture had a history of previous hemiplegia or transient hemiparesis [5].

Conclusions

In the present study, documentary evidence of previous hemiplegia was found in 67 patients. As the study is retrospective, it probably underestimates the incidence of hip fracture after stroke. Prospective studies are required to ascertain how commonly hip fracture occurs in hemiplegic patients, to determine the relative importance of the factors predisposing to falls and fractures in patients with stroke, and to decide whether specific rehabilitation methods are effective in reducing the tendency to fall and fracture bones on the hemiplegic side.

For the moment, a pragmatic strategy for a stroke unit might be to consider non-pharmacological measures such as adequate sunlight exposure, early physiotherapy and pharmacological measures such as vitamin D and calcium supplementation for hemiplegic patients, and also to develop effective technologies for prevention of falls. Prevention of falls, both during stroke rehabilitation and afterwards, is clearly of major importance in preventing hip fractures. An important

goal in the management of patients with spasticity involves restoration of normal limb position and ease of passive and/or active movement, with the aim of improving functional outcomes such as the ability to carry out activities of daily living.

So attention must be focused on stroke as a major and increasing risk factor for femoral neck fracture and also on the poor postfracture outcome and reduced survival of these patients. Prevention of poststroke fractures is necessary and is aimed at reducing the risk of poststroke fall and preventing the development of hemiosteoporosis.

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