PREVALENCE OF FALLS AND ITS ASSOCIATED FACTORS AMONG ELDERLY DIABETES ATTENDING KLINIK PAKAR PERUBATAN AND KLINIK RAWATAN KELUARGA HOSPITAL UNIVERSITI SAINS MALAYSIA

By

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ABBREVIATIONS

DM	Diabetes mellitus
KRK	Klinik Rawatan Keluarga
KPP	Klinik Pakar Perubatan
SPSS	Statistical Package for Social Science
ADL	Activity of Daily Living
OR	Odds ratio
HUSM	Hospital Universiti Sains Malaysia
FBS	Fasting blood sugar
HbA1C	Glycated hemoglobin
LDL	Low density lipoprotein
SD	Standard deviation
BP	Blood pressure
BMI	Body Mass Index
OHA	Oral hypoglycemic agent
PS	Power and sample size
WHO	World Health Organisation

ABSTRAK

Objektif: Kajian untuk menentukan prevalens kejadian jatuh dan faktor-faktor berkaitan dengannya di kalangan warga tua mengidapi penyakit kencing manis yang menghadiri klinik-klinik pesakit luar (KPP&KRK) HUSM.

Metodologi: Ini adalah kajian lintang yang melibatkan 288 warga tua yang berumur 60 tahun dan ke atas dan mengidapi penyakit kencing manis di klinik pesakit luar (KRK&KPP), HUSM dari bulan April 2007 hingga March 2008. Pesakit ditemuramah untuk mendapatkan data sosiodemografi, sejarah penyakit, penggunaan ubat-ubatan dan fungsi sosial. Pemeriksaan fizikal, keseimbangan badan dan pergerakan juga dilakukan. Laporan rekod hospital pesakit juga di teliti untuk mengenalpasti rawatan yang diberikan, keputusan darah yang terkini dan lain-lain masalah perubatan. Kejadian jatuh ditafsirkan jika berlaku dalam masa satu tahun kebelakang dari masa di temuramah.

Keputusan: Prevalens kejadian jatuh di kalangan warga tua yang mengidapi kencing manis adalah 18.8%. Di kalangan pesakit yang jatuh, peratusan mereka yang jatuh berulang kali adalah 72.2. Wanita (OR: 2.54, $p<0.05$), umur melebihi 75 tahun (OR: 2.97, $p<0.05$), adanya diabetes retinopati (OR: 2.19, $p<0.05$), adanya orthostatic hypotension (OR: 2.87, $p<0.05$) adalah berkaitan dengan kejadian jatuh dikalangan warga tua mengidapi diabetes. Skor keseimbangan dan gaya berjalan (Balance and Gait score) yang tinggi mempunyai risiko jatuh yang rendah dikalangan warga tua yang mengidapi diabetes (OR: 0.89, $p<0.05$).

Kesimpulan: Kajian ini mendapati prevalens kejadian jatuh dikalangan warga tua yang mengidapi penyakit kencing manis adalah lebih rendah berbanding kajian di negara barat. Kejadian jatuh adalah berkaitan dengan wanita, berumur lebih dari 75 tahun, adanya diabetes retinopati dan orthostatic hypotension. Warga tua yang mempunyai skor (Balance and Gait score) yang tinggi kurang berisiko untuk jatuh dibandingkan mereka yang mempunyai skor yang rendah.

ABSTRACT

Objectives: To assess the prevalence of fall and its associated factors among elderly diabetes type 2 attending outpatient clinics (KPP&KRK), HUSM.

Methodology: This is a cross sectional study conducted in outpatient clinic HUSM from April 2007 till March 2008, among 288 elderly diabetes type 2. The patient was selected using systematic random sampling method. Baseline data on socio-demographic, diabetes history, co-morbid diseases, drugs use and activity of daily living (Barthel's index) were performed. The patient also was examined physically and balance and gait assessment was carried out. Review of patient's medical record for laboratory investigations result and medication and concomitant illness were also done. Falls was defined having at least one history of falls in the past one year from the interview date.

Result: Prevalence of falls among elderly diabetes was 18.8 %. Among the faller group, 72.2 % had more than one falls. Female gender (OR: 2.54, p<0.05), age group more than 75 (OR: 2.97, p<0.05), retinopathy (OR: 2.19, p<0.05), orthostatic hypotension (OR: 2.87, p<0.05) were associated with higher risk for falls. High balance and gait score was associated with reduced risk of fall in elderly diabetes (OR: 0.89, p<0.05).

Conclusion: In this cross sectional study among elderly diabetes type 2, the prevalence of falls were found to be lower compared to previous study in the western countries. The factors that associated with higher risk for fall were female sex, age group more than 75, presence of retinopathy and orthostatic hypotension. Those who had higher Balance and Gait score were found to be less likely to fall compare with those with lower score.

CHAPTER ONE

INTRODUCTION

1.1 Epidemiology of elderly population

The number of elderly population is growing very rapidly. It is estimated that in 2050 the world's elderly population will have quadrupled to 1.445 billion, while the total global populations will have less than doubled to 9.8 billion (Hugo, 2008). Asia's share of the global elderly population will have increased to 878.4 million or (60.8) % of the world's elderly, while its share of the total world population will fall to 58.4 per cent. According to the Economic and Social Commission for Asia and the Pacific (ESCAP), the number of elderly people aged 60 and over in Asia will be more than double from 322 million in 2000 to about 705 million in 2025. China, for example, is expected to double its older populations from 10 to 20 percent between 2000 and 2027. In United State of America the expert estimate that more than 50 million American about (17.0) % of the population will be 65 or older in 2020 (1996b). Similarly in United State, the rate of growth of the elderly population (persons 65 years old and above) has greatly exceeded the growth rate of the population of the country as a whole. The elderly increased by a factor of 11, from 3 million in 1900 to 33 million in 1994. In comparison, the total population, as well as the population under 65 years old, tripled. About 1 in 8 Americans were elderly in 1994, but about 1 in 5 would be elderly by the year 2030 (Day, 1993).

At present, the number of Malaysians aged 60 years and above is estimated to be 1.4 millions and is projected to increase to 3.3 million in the year 2020. In 2020 the elderly population is expected 9.8% of total population of Malaysia of 33.7 million (1999). Thus, clearly Malaysia nation is ageing rapidly like many countries. The total increasing number of elderly population may be due to the decline in fertility and mortality rate among Malaysian as a developing countries (Arokiasamy). As a result of improved economies, better access to health facilities, education and housing, many of the world's population including Malaysia are living longer. The pattern of life expectancy at birth of a Malaysian has increased from 66 years in male and 70.5 years in female in 1980 to 71.0 years in male and 76.0 years in female in 2004 (2003). This figure had improved by more than 40 percent since Malaysia achieved its independence in 1957.

The aged population has its own unique problems and this will generate new challenges and demand on the health, social services and financial implications. This undoubtedly requires a sharing of responsibilities between the government, private sector, non-government agencies and the community. The demand for care and services for elderly is clearly being recognized and effective implementation of policies in elderly is becoming crucial (Rabieyah and Hajar, 2003). On 25 October 1995, the Malaysian Government formulated the National Policy on the Elderly. This policy for the elderly in Malaysia defined elderly as those over 60 years of age, adopting the similar criteria with World Health Organization (WHO) set at the World Assembly on Aging in Vienna in 1982 (1996b). This policy consist of a plan of action which is comprehensive and contains proposals for action as well as programs and activities that needs to be implemented by

all governmental agencies, the private sector, the non-governmental organizations, society, groups and individuals. These programs and activities cover education, employment, participation in society, well-being, transportation, housing, support system by the family, health, social security, the media and research and development (1996b).

Health problems increases with age (Harris *et al.*, 1995). Eighty percent of people over 65 have long term disorders and five percent have disabilities that require continuous medical supervision. Physical and social changes associated with ageing are combined with the debilitating effects of multiple, acute and chronic diseases (Mafauzy, 2000). Specific health problems due to old age such as cardiovascular diseases, osteoporosis, diabetes, cataracts, arthritis and glaucoma can cause severe stress, anxiety and depression and even rise in mortality. The fastest growing age group is the population aged 80 and over, the very segment of the population that tends to require expensive and intensive medical care. This will place an increased burden on the healthcare system and a concomitant rise in total health care costs.

Socioeconomic implications of increasing elderly population include increase in societal dependency, increase in working life expectancy, unemployment of older persons, modernization and status of the elderly. Females are the majority among the elderly and with the increased life expectancy in them, this will also increased female labor force participation and widowhood. In short, the elderly were vulnerable to various socioeconomic deprivations. To ensure the elderly groups are not neglected, the kind of public intervention called for includes: institutional live in care; medical services; day

care arrangements; assurance of a reasonable income in retirement; and legislation against employment discrimination.

1.2 Falls in elderly

1.2.1 Definition of falls

Early definition of falls in the literature suggested 'when the vertical line which passes through the centre of mass of the human body comes to lie beyond the support base and the correction does not take place in time' (Isaacs, 1985). However it is not practical to use in the clinical studies. Most studies now required the fall to be 'unintentional' and a contact with the ground and excluded falls caused by the road accidents and violence (Masud and Morris, 2001). For example, Tinetti in 1998 defined fall as an event which results in a person coming to rest unintentionally on the ground or other lower level, not as a result of a major intrinsic event (such as stroke) or overwhelming hazard (Tinetti *et al.*, 1988). Nevitt *et al.* (1991) definition involved a person 'falling all the way down to the floor or ground, or falling and hitting an object like a chair or stair (Nevitt *et al.*, 1991). More recent definition of fall defined 'unexpected event from an upright, sitting or horizontal position, the descent height being less than 1 meter (Kannus *et al.*, 1999). Thus it is important to take note the definitions of falls when interpreting the clinical studies.

1.2.2 Burden of falls

Falls are common among elderly and are recognized as significant health problem in them. This is due to complications arising from the falls cause significant decrease in functional status, serious injury and utilization of medical services (Tinetti *et al.*, 1995, Nevitt *et al.*, 1991). Falls are responsible for complications include bone fractures, injury to the soft tissues, increased functional dependence, and fear of falling again, which itself can be debilitating (Tinetti *et al.*, 1995). Each of these complications contributes to increased risk of future falls (Schwartz *et al.*, 2005). Elderly often are frail and already have preexisting impaired daily functions. Function and quality may deteriorate drastically after a fall. After falling, elderly people may fear falling again, so mobility is sometime reduced because confidence is lost. Some people may even avoid certain activities (e.g., shopping, cleaning) because of this fear. Decreased activity can increase joint stiffness and weakness, further reducing mobility (Mark H. Beers *et al.*, 2000). More frequent falling is an independent predictor of the likelihood of experiencing a serious injury such as hip fracture (Schwartz *et al.*, 2005). Up to 20% of people sustaining a hip fracture become non ambulatory, and only 14-21% recover their ability to carry out instrumental activities of daily living (Baker *et al.*, 1992). The high incidence of fall means a very high cost in terms of health care expenditure as well (Rizzo *et al.*, 1998). In 1996 more than 250,000 older American suffered hip fracture, at a cost in excess 10 billion (Fuller, 2000). However the true cost of falls in Malaysia health care system is difficult to ascertain due to inadequacy of data.

1.2.3 Prevalence of falls among elderly

Each year, approximately 30% of community dwelling persons over age 65 and 50% of those over 80 years fall (Tinetti *et al.*, 1995). In Health, Well Being and Aging (SABE) project in Latin America and the Caribbean study from seven cities to 9765 subjects, Reyes (2004) found that prevalence of fall in elderly in Latin America were 21.6% in Barbados and 34.0% in Chile (Reyes-Ortiz *et al.*, 2004). Frequency of falls is significantly higher in nursing homes than in community (Rubenstein *et al.*, 1994). The study by Rubenstein *et al.* found that there was 4% of nursing home falls per year and 11% are associated with serious soft tissue injuries (Rubenstein *et al.*, 1994).

However, the studies done in the South East Asian countries found that there was lower prevalence of falls among the elderly. In a study done among elderly age over 60 years in Thailand, the prevalence of fall is 19.8% (Assantachai *et al.*, 2003). The study also noted that the prevalence of fall among female elderly is 24.1% whereas in male the prevalence is 12.1 %. The prevalence of fall in elderly Thailand was almost similar in Hong Kong and Singapore. The study by Chu *et al.* (2005) in Hong Kong showed that the prevalence of fall among elderly age more than 65 years was 19.3% (Chu *et al.*, 2005). Prevalence of falls among community dwelling in Singapore was reported 17.2 % (Chan *et al.*, 1997).

In Malaysia, the Second National Health and Morbidity Survey Malaysia showed that prevalence of home injuries (sustained during the preceding years) among those 60 years or more was 12.8% (Srinivas). The average home injury episode per person in the

preceding years ranged from 1.2 to 6.9 and average number of disability days ranged from 7.8 to 36.9% for the same age group (Srinivas). This prevalence was surprisingly lower compare to neighboring countries such as Singapore and Thailand mentioned earlier.

1.3 Risk factor for falls

In the past, the evaluation of falls focused on attempting to identify the single cause of a fall. The falls in elderly are rarely due to a single cause. However since 1980s it has been identified that most falls are multi factorial and that the risks of falling increases with the number of risk factors (Tinetti *et al.*, 1986). A study by Tinetti and colleagues found the risk of falling increased from 19% when one risk factor was present to 78% in the presence of 4 or more risk factors. Most of falls in the elderly are due to cumulative effects of factors intrinsic to patients (age related decline, chronic disease, acute illness, medications), challenges to postural control (environment, changing positions, normal activities), and mediating factors (risks taking behavior, underlying mobility problems).

The risk factors for fall in the hospital setting or institutional may differ from community dwelling individuals. Few community based prospective cohort studies of risk factors for falls identified age, cognitive impairment, female gender, past history of a fall, lower extremity weakness, balance problems, psychotropic drug use and arthritis as a risk factor (Reyes-Ortiz *et al.*, 2005, Tinetti *et al.*, 1988, Chu *et al.*, 2005). The hospital environment itself may either be a supportive environment (e.g., the presence of handrails and no-slip

bathing surfaces) or may contribute to fall risk (e.g., unfamiliar rooms, improper bed height) (Agostini *et al.*, 2001). Study in elderly in a nursing home also have identified poor vision, cognitive and functional impairment, sedating and use of psychoactive medications, environmental hazard as a risk factors for fall (Rubenstein *et al.*, 1994). Another study in nursing homes found that falls were significantly correlated with fractures, use of wheelchair, safety belts and bedrails (Murata, 2008). Frequently overlooked, environmental factors can increase susceptibility to falls and other accidents (Stevens and Olson, 2000). Risks factor that have been identified in various studies are presented below:

1.3.1. Socio demographic factor

a. Increasing age

Falls increase with increasing age, and the risk triples from age 70 to age 90 (Campbell *et al.*, 1989). Physiological changes which associated with aging process may increase susceptibility of falls in elderly (Tinetti and Speechley, 1989). The changes in the visual perception, muscular strength in the legs and ankles, increased body sway and prolonged reaction times increase propensity to fall in elderly.

b. Gender

Gender is a key factor as woman was more likely to fall than man and sustain more injuries when they fall (Kronfol). Female gender were associated with a greater prevalence of falls and also an independent risk factors for recurrent falls (Chu *et al.*, 2005). A study that investigated the association of amount of skeletal muscle in a

person's leg noted that women who have lower leg mass significantly have higher relative risks for fall compared to man (Rose and Waters, 1998). Other major contributory factor could be due to osteoporosis that commonly preexisting in elderly women (Rubenstein *et al.*, 1994).

c. Living alone

Living alone has been demonstrated as a risk factor for fall in elderly (Miller *et al.*, 1999b). Those living alone were more likely to report fair or poor health, poor vision, difficulties in instrumental and basic activities of daily living, worse memory and mood, lower physical activity, poorer diet, worsening function, risk of social isolation, hazardous alcohol use, having no emergency caretaker, and multiple falls in the previous 12 months (Kharicha *et al.*, 2007).

d. Use of assistive device

The use of an assistive device are associated with a threefold increased risk for falling (Tinetti *et al.*, 1988). The examples of assistive devices used in elderly were cane, walker, crutch, and wheelchair. The use of assistive device presumed a marker for impaired gait because when it is well fitted, it should improve safety (Rubenstein *et al.*, 1994). However, poorly maintained or improperly fitting wheelchairs and/or assistive devices may increase the rate of falling in elderly.

1.3 2 Co morbid medical illness

Many studies have shown that fallers tend to have more medically diagnosed conditions than people who do not fall (Tinetti *et al.*, 1988). Stroke and Parkinson's disease are among central nervous disorder that possessed certain risk for falls in the elderly. Depression appears to be an independent risk factors for falls (Rubenstein *et al.*, 1994). Dementia can increase the number of falls by impairing judgment, visual-spatial perception and ability to orient oneself geographically (Rubenstein *et al.*, 1994). Confusion and cognitive impairment are frequently cited as causes of falls in elderly (Kallin *et al.*, 2005).

1.3.3 Medication Use

Poly pharmacy in elderly increases the risk of falling (Leipzig *et al.*, 1999, Robbins *et al.*, 1989). The variety of prescribed medicine is increasing and combination with herbs, supplement and vitamins may also cause falls among elderly. The usage of any psychotropic medication including sedatives/hypnotic, antidepressant, short or long acting benzodiazepines and neuroleptic increased the risks of falls (Leipzig *et al.*, 1999). This medication can affect alertness, judgment and coordination.

1.3.4 Visual impairment

Visual impairment has been found to be correlated with risks factor for falls elderly (Lamoureux *et al.*, 2008). It doubled the risk for falls in elderly (Blake *et al.*, 1988). It could be due to inability to maintain upright posture which depends from sensory input from visual, proprioceptive and vestibular system. Common condition of visual

impairment includes decline in visual acuity, decline in accommodative capacity, glare intolerance, altered depth perception, presbyopia, decreased night vision and decline in peripheral vision. For age related visual impairment in elderly, the common causes were presbyopia, cataract, age related macular degeneration, primary open angle glaucoma and diabetic retinopathy (Loh and Ogle, 2004).

1.3.5 Impaired balance and gait disorder

Age related changes in the neural, sensory and musculoskeletal systems can lead to impaired ability to maintain upright stance to a sudden loss of balance (Kronfol). Other deterioration that include impaired gait including increased postural sway, prolonged reaction time and depth perception. The risk of balance and gait disorder increases the fall risk to three fold in elderly (Rubenstein and Josephson, 2002).

1.3.6 Foot problem

Serious foot problem are common in older people and are associated with impaired balance and functional ability. The common condition observed in elderly such as reduced ankle flexibility, hallux valgus deformity, decreased tactile sensitivity, decreased toe plantar flexor strength, and foot pain are important risk factors for falls in older people (Keegan *et al.*, 2002).

1.3.7 Orthostatic hypotension

Orthostatic hypotension is common among elderly person living at home with prevalence of 5% to 25 % (Low, 2008). It is more common in persons with hypovolemia, low

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