

Comprehensive Approach for Managing the Older Person with Diabetes Mellitus

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Care of the elderly population with diabetes may not be restricted to the management of hyperglycemia, associated risk factors, and specific diabetic complications. An integrated approach should also include the assessment and management of gerontological problems. Both diabetes mellitus and aging interact toward the direction of the increased incidence of geriatric syndromes. Education is a common element of both diabetes control and geriatric syndrome care. However, it has been perceived that conventional education programs for diabetics are not as effective for the elderly. We have designed geriatric reinforced education (GRE) for application in older diabetics with geriatric syndromes. We observed that the application of GRE improved the glucose control and the status of geriatric syndromes in older adults with diabetes. In summary, in terms of integrating the care of coexisting diabetes and geriatric problems, GRE may be a beneficial tool for the management of older adults with diabetes.


Keywords: Diabetes mellitus; Education; Geriatric assessment

The Sulwon Award for Scientific Achievement is the Korean Diabetes Association's highest scientific award and honors an individual who has excellently contributed to the progress in the field of diabetes and metabolism. Sulwon Award is named after an emeritus professor Eung Jin Kim, who founded Korean Diabetes Association. Prof. Hyung Joon Yoo received the eighth Sulwon Award at 2016 International Conference on Diabetes and Metabolism, October 13 to 15, 2016 at Seoul, Korea

INTRODUCTION

Diabetes has emerged as an important social issue worldwide. The World Health Organization has reported that approximately 422 million adults were living with diabetes in 2014, and the global prevalence was approximately 8.5% [1]. In Korea, 11% of men and 8% of women had diabetes, according to

the 2015 Korea National Health and Nutrition Examination Survey. Importantly, the prevalence of diabetes increased rapidly by aging: 6.9% to 12.6% at 50 to 59 years; 17.1% to 22.4% at 60 to 69 years; and 23.5% to 25% at over 70 years [2]. Because a significant portion of the morbidity by diabetes is preventable, optimized management for the elderly population is clinically important. There were many overlapping factors of diabetes control between the young and the elderly. However, most of the elderly with diabetes are also faced with gerontological problems. Therefore, for the best care of diabetes in the elderly population, optimized management should be established based on the approach of gerontology [3]. Gerontology is the study of old age, the process of aging, and the problems of old people. It is composed of three fields: biology, sociology, and medicine [4]. For the comprehensive understanding of gerontology, integrated studies of biology, sociology, and medicine are essential (Fig. 1).

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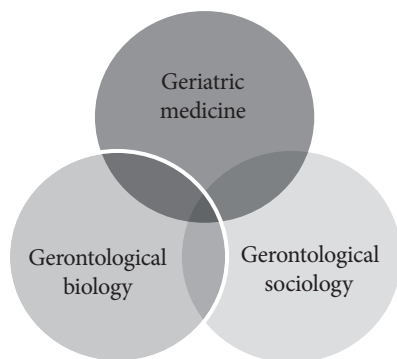


Fig. 1. Fields of gerontology.

STUDIES OF GERONTOLOGY

In our laboratory, we conducted several studies in all fields of gerontology [4-11]. We focused especially on vascular aging for gerontological biology [12-15], health literacy for gerontological sociology [16], and geriatric syndromes for geriatric medicine [17,18].

Studies of gerontological biology

Concerning vascular aging, we investigated the proliferation of vascular smooth muscle cells (VSMCs) in atherosclerosis [19]. In one of the studies, we investigated the effects of rutin on VSMCs. Rutin is one of the major flavonol subclasses of flavonoids and has various pharmacological activities. We investigated the effects of rutin on VSMC proliferation and migration according to fluctuating glucose levels. The glucose-fluctuation-induced phosphoprotein levels of extracellular signal-regulated kinase 1/2 (ERK1/2), MEK1/2 (mitogen-activated protein kinase kinase), phosphoinositide 3-kinase (PI3K), and nuclear factor κ B (NF- κ B) were reduced in cells pretreated with 30- μ M rutin 72 hours prior to glucose fluctuation, compared to treatment with normal glucose. We examined whether glucose fluctuation in the presence or absence of rutin affected the migration of VSMCs. Cell migration and phosphor-big mitogen-activated protein kinase 1 (BMK1) protein levels were higher in cells exposed to glucose fluctuation. Rutin inhibits the migration of VSMCs and the expression of BMK1 under conditions of glucose fluctuation (Fig. 2). We also found elevated reactive oxygen species levels induced by glucose fluctuation were decreased by rutin treatment in a fluorescence spectrophotometric analysis [8]. In summary, fluctuating glucose levels increased the proliferation and migration of Otsuka

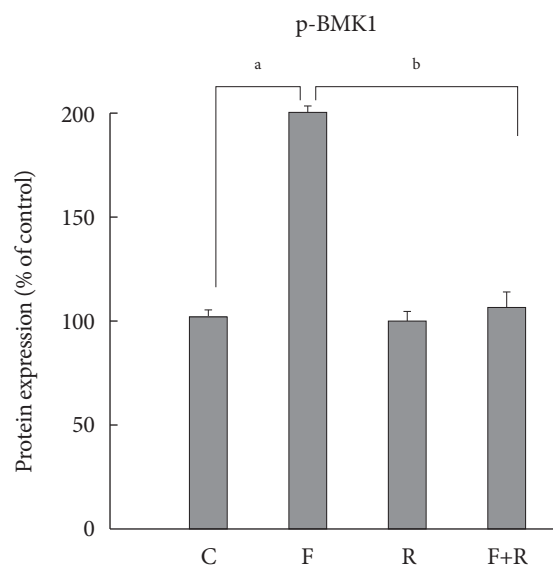


Fig. 2. Inhibitory effects of rutin on glucose fluctuation-induced vascular smooth muscle cell migration in Otsuka Long-Evans Tokushima fatty rats. The inhibitory effect of rutin on BMK1 (migration pathway) was by Western blot analysis. Five separate experiments were performed. P-BMK1, phosphorylated-big mitogen-activated protein kinase 1; C, control; F, glucose fluctuation; R, rutin. ^a $P < 0.05$ vs. control, ^b $P < 0.001$ vs. glucose fluctuations.

Long-Evans Tokushima fatty rat VSMCs via MAPK (mitogen-activated protein kinase) (ERK1/2), BMK1, PI3K, and NF- κ B pathways. These effects were inhibited by the antioxidant rutin.

Studies of gerontological sociology

Concerning the gerontosocial aspect of elderly diabetics, we focused on health literacy. In 84 elderly diabetics, the level of health literacy and its influence factors were measured. Only 23.8% of elderly diabetic patients had appropriate health literacy (Fig. 3) [9,20]. The factors that have a significant relationship with the health literacy were education level, monthly income, and knowledge of diabetes. In summary, older persons with diabetes are heterogeneous in social aspects, including health literacy.

Studies of gerontological medicine

We studied geriatric syndromes as the representative geriatric subject deeply associated with elderly diabetics [11]. In 175 elderly diabetics, the prevalence of disability was 35.3%, depression 28.5%, malnutrition 38.2%, and osteoporosis 20.3%. Functional disability and malnutrition were especially remark-

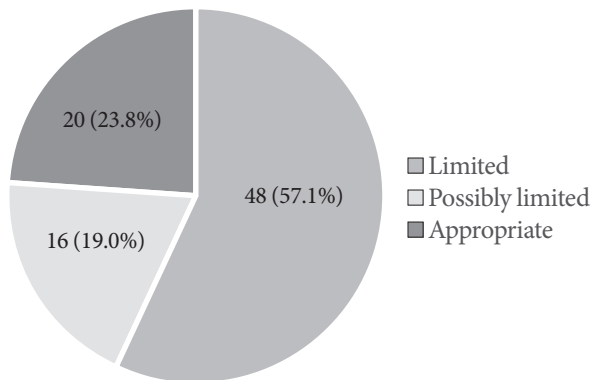


Fig. 3. Health literacy in older persons with diabetes mellitus (n=84).

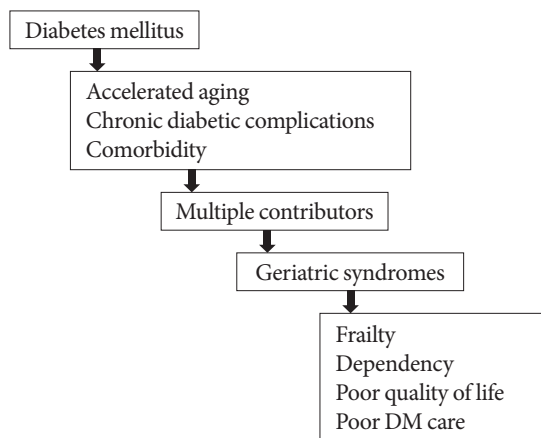


Fig. 4. Diabetes mellitus (DM) and aging interact toward the direction of the increased incidence of the geriatric syndromes.

able. A total of 81 patients had both of these syndromes. Geriatric syndromes characteristically highlight the unique features of common health conditions in the older person. Both the diabetes mellitus (DM) and the aging interact toward the direction of the increased incidence of geriatric syndromes (Fig. 4). Therefore, care of the older person with diabetes may not be restricted to the management of hyperglycemia, associated risk factors, and specific diabetic complications.

EDUCATION AS AN INTEGRATED APPROACH OF GERONTOLOGICAL PROBLEMS

There has been a lot of progress in the management of diabetes. However, it is often impractical to extrapolate from the

Table 1. Items in geriatric reinforced education

Subject	Content
Overview	Aging, geriatric syndromes (definition, basic precautions)
Healthy aging (nutrition)	Regularity, dental, social taste
Being active (disability)	Muscle strengthening exercises, safety
Reducing risks (home environment modification)	Lighting, flooring, stairwells, bathroom, kitchen, walkways, emergency devices, and communication systems

young adult to the elderly, especially the frail or dependent ones. Considering that there is plenty of evidence that geriatric syndromes are prevalent in the elderly with diabetes, its optimized management has to include not only glycemic control and prevention of DM complications, but also the treatment of gerontological problems [21-24].

Education is one of the most practical ways to be easily assessed due to the overlapping factors of diabetes control and geriatric care, especially geriatric syndromes care. However, conventional DM education has limitations for the elderly who have functional and cognitive problems. In addition, the status of these conditions may change for individuals over a short period of time [25-27]. Older people are less likely to comply with behavioral modifications, including diet. This poor compliance may be due to the lack of specialized education for elderly diabetics. Programs have been shown to improve knowledge, metabolic control, desirable lifestyle changes, and psychological functioning [28]. The content of diabetes educational programs needs to be adapted to the elderly with different degrees of independence and comorbidity [29]. Therefore, the education should be modified with an integrated approach for glycemic control and geriatric problems.

To evaluate the effect of education in the management of geriatric syndromes in elderly patients with DM, we designed geriatric reinforced education (GRE) (Table 1) for application in older diabetics with geriatric syndromes. We randomly divided 60 elderly diabetics with two geriatric syndromes (disability and malnutrition) into two groups: GRE and conventional education. GRE was reinforced with the educational content of aging, geriatric syndromes, and their prevention. The education team comprised two geriatricians, one dietitian, two nurses, one pharmacist, and one social worker.

After 6 months of education, there was no significant decrement of the percentage of patients with disability and the scoring points of disability in both the reinforced group and the

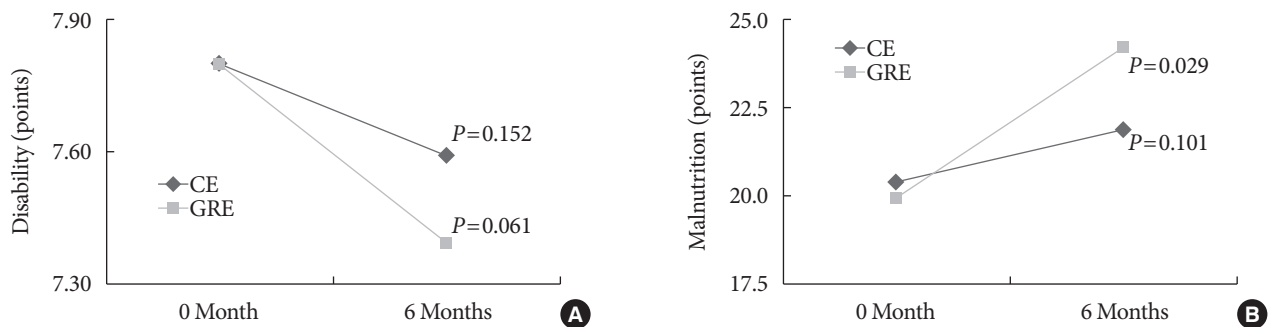


Fig. 5. Education effects on (A) disability and (B) malnutrition after 6 months' education. Conventional diabetes education (CE, $n=30$), geriatric reinforced education (GRE, $n=30$). When the activities of daily living score is <7 , the functional status is considered as disabled. When the mini nutritional assessment is ≥ 24 , the nutritional status is considered good.

conventional group. Nevertheless, there was a significant change in malnutrition scoring points in the reinforced group (Fig. 5).

GRE has made a significant change in the geriatric syndrome state of older diabetics. In terms of the mutually influencing effects of coexisting diabetes and geriatric syndromes, education may be the fundamental and most practical tool of the management of geriatric problems in older diabetic patients.

CONCLUSIONS

There were many overlapping factors of diabetes control between the young and the elderly population. However, most of elderly with diabetes are also faced with gerontological problems. Therefore, for the best care of diabetes in the elderly population, optimized management—which includes not only glycemic control and prevention of DM complications, but also the treatment of gerontological problems—should be established based on an integrated approach of gerontological characteristics, including gerontological biology, sociology, and geriatric medicine. One of the major end-points of this management is to reduce the impact of hyperglycemia on the progression of geriatric syndromes, such as malnutrition and disability. Considering that education is one of the most important aspects of the management of diabetes and geriatric problems, GRE may be a beneficial tool for the management of the elderly with diabetes.

CONFLICTS OF INTEREST

No potential conflict of interest relevant to this article was reported.

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