DIABETES RESEARCH AND CLINICAL PRACTICE 130 (2017) 34–42

Contents available at ScienceDirect

Diabetes Research and Clinical Practice

journal homepage: www.elsevier.com/locate/diabres

International Diabetes Federation

Effect of re-coaching on self-injection of insulin in older diabetic patients – Impact of cognitive impairment

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ARTICLE INFO

Article history:
Received 1 November 2016
Received in revised form
2 May 2017
Accepted 8 May 2017
Available online 12 May 2017

Keywords:
Insulin treatment
Cognitive impairment
Diabetes mellitus
Self-injection

ABSTRACT

Aims: We investigated the effect of re-coaching on self-injection of insulin and impact of cognitive function in 100 older diabetic patients.
Methods: We examined patients on a variety of skills and knowledge regarding self-injection of insulin and evaluated the effect of re-coaching the patients after 3 months and 4 years. We also investigated the influence of cognitive impairment (CI) on coaching.
Results: Skills scores for self-injection of insulin and HbA1c improved significantly 3 months after re-coaching. In 51 patients followed-up for 4 years, skills scores were maintained during the 4 years, while knowledge scores improved after 3 months but then returned to the baseline level. In the group of patients with CI as determined by the Mini-Mental Status Examination, skills scores were similar to those in the group without CI, while knowledge scores were significantly lower as compared with those in the group without CI at any time point. Skills scores were maintained during the 4 years regardless of CI.
Conclusion: The present study showed that re-coaching in skills for self-injection of insulin was effective in improving and maintaining insulin treatment in older diabetic patients, even if patients had CI.

1. Introduction

The number of older people with diabetes is increasing as a result of increased average life expectancy and changes in lifestyle. Recently, although medication for diabetes has greatly improved and become easier to administer thanks to the development of new hypoglycemic agents, there are still many patients requiring insulin. It has been reported that insulin therapy was initiated in one-third of patients within the first year after diagnosis and about 70% of them were

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http://dx.doi.org/10.1016/j.diabres.2017.05.011

older people aged more than 60 years [1]. Therefore, the number of older diabetic patients in whom insulin therapy is initiated is also expected to increase. However, a critical issue in older patients injecting themselves with insulin is the complication of hypoglycemia. In this regard, asymptomatic hypoglycemia has been reported to be frequent in older patients [2], and that severe hypoglycemia may cause cognitive dysfunction [3] in addition to mortality [4] and cardiovascular events [5].

Since incorrect or inaccurate self-injection of insulin may bring about poor diabetic control and hypoglycemia, adequate coaching in the injection technique is vital [6]. Although routinely and repeatedly testing injection skills has been reported to be necessary [7], this may be difficult to do for all patients. Therefore, we examined skills in self-injection of insulin and knowledge regarding it in older diabetic patients, who were living independently at home and injecting themselves with insulin, gave them coaching and later evaluated its effect.

Previous large-scale epidemiological studies have reported that the incidence of dementia in diabetic patients is about twofold higher than in non-diabetic people [8,9]. Also, cognitive impairment has been observed in many older diabetic patients in the clinical setting [10]. It has also been reported that hypoglycemia rates increased with aging, that rates further increased with insulin treatment and increased even more as cognitive impairment advanced [11]. Once older patients with self-injection of insulin develop dementia, it may be impossible to maintain self-care in insulin therapy and hypoglycemic events may occur. In this case, the interaction between hypoglycemia and dementia may lead to a vicious cycle [12]. This will be even more serious for older patients without caregivers to support their insulin therapy. Therefore, we also performed a global cognitive test and studied the influence of cognitive impairment on coaching from the results.

2. Research design and methods

2.1. Subjects

We consecutively recruited 100 older diabetic patients aged more than 65 years (mean 75.2 ± 6.2 years, 49 males and 51 females), who were living independently at home and injecting themselves with insulin for the present study between April and August 2010. They included five patients with type 1 diabetes. We examined their skills in self-injection of insulin and coached them in areas requiring improvement at baseline and also tested their knowledge regarding self-injection. We evaluated the effect of coaching after 3 months as well as between January and July 2014 (mean period 3.8 ± 0.2 years). A total of 30 patients were excluded from the analysis after the 4-year period because during it, 13 had died, 11 were institutionalized, and six dropped out. Another 19 patients were excluded. Sixteen of them were changed from insulin to oral hypoglycemic agents (11 patients) or glucagon-like peptide-1 receptor agonists (5 patients), two were excluded due to difficulty in self-injection, and one because they were receiving continuous subcutaneous insulin infusion. Thus, the final number of patients in whom we re-examined skills in insulin self-injection was 51 (mean 77.3 ± 5.3 years, 26 males and 25 females), including three patients with type 1 diabetes.

2.2. Evaluation of skills and knowledge with respect to insulin self-injection (Table 1)

We checked nine skill-related actions in insulin self-injection, giving a point for each correctly performed action. An overall evaluation was made using the total number of points. As a separate skill-related item, if a patient used cloudy insulin, we also checked their ability to make a re-suspension correctly. In addition, we tested seven knowledge-related items in insulin self-injection. Well-trained nurses then coached patients in the correct procedure for insulin injection and gave them the correct information regarding the knowledge-related items.

2.3. Cognitive function of patients

For assessment of cognitive function, we selected a global cognitive function test, Mini-Mental Status Examination (MMSE). The MMSE was used to assess orientation, registration, attention, calculation, language, and recall, with a score range from 0 to 30 [13]. The cut-off value of the MMSE for dementia is 23 or 24 and we defined cognitive impairment as a score lower than 24.

2.4. Clinical and biochemical characteristics of patients

Fasting blood samples were separated, and analyzed. Low density lipoprotein (LDL)–cholesterol, high density lipoprotein (HDL)-cholesterol, triglycerides, and fasting blood glucose were measured using an autoanalyzer and routine enzymatic techniques. Hemoglobin A1c (HbA1c) was measured using high-performance liquid chromatography (HLC-723G7, Tosoh, Tokyo, Japan), and HbA1c was estimated as a National Glycohemoglobin Standardization Program (NGSP) value (%), calculated by the formula HbA1c (%) = HbA1c (Japan Diabetes Society [JDS]) (%) $\times$ 1.02 + 0.25 [14]. Estimated glomerular filtration rate (eGFR) was calculated from the following three-variable Japanese equation: GFR (mL/min/1.73 m^2) = 194 $\times$ serum creatinine$^{-1.094}$ $\times$ age$^{-0.287}$ $\times$ 0.739 (if female) [15]. Albuminuria was defined as albumin to creatinine ratios (ACR), which were calculated from the measurement of albumin (mg) and creatinine (g) in spot urine, as follows: normoalbuminuria: < 30 mg/g creatinine, micro-albuminuria: 30–299 mg/g creatinine, macro-albuminuria: $\geq$ 300 mg/g creatinine. Neuropathy was evaluated from the presence of a combination of symptoms and signs of neuropathy including any two or more of the following: neuropathic symptoms, decreased distal sensation, or unequivocally decreased or absent ankle reflexes [16]. Retinopathy was classified as normal, simple and preproliferative, and proliferative by ophthalmologists. Severe hypoglycemia was defined as an event requiring assistance of another person to actively administer carbohydrates, glucagon, or take other corrective actions [17].