

Hypoglycaemia in the elderly with diabetes in hospital: a literature review

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INTRODUCTION

Diabetes Control and Complication Trial (DCCT) and the United Kingdom Prospective Diabetes Study (UKPDS) suggest tight glycaemic control can reduce the incidence of long term diabetes complications.^{1,2} Unfortunately, the risk of hypoglycaemia increases with tight glycaemic control. Hypoglycaemia is an unwanted adverse effect for people with diabetes who are treated with insulin or insulin secretagogues. Hypoglycaemia-related events can be serious, involving seizures or brain injury.³ In particular, the elderly can suffer from injuries and die as a result of hypoglycaemia events.⁴ It is important to understand why hypoglycaemia occurs and to develop effective prevention strategies for hypoglycaemia in the older population.⁴ It is also essential to understand the clinical manifestations of hypoglycaemia, the prevalence of hypoglycaemia in the elderly and its predisposing factors.

In this study, the prevalence of hypoglycaemia among older people with diabetes, clinical manifestations, causes and risk factors of hypoglycaemia will be discussed. In addition, the association between hypoglycaemia and falls, the link between hypoglycaemia and mortality risk, and the adverse affect on health-related quality of life in the elderly will be explored. Furthermore, prevention strategies for hypoglycaemia in the hospital and the role of education for the elderly about hypoglycaemia will be identified.

PREVALENCE OF HYPOGLYCAEMIA IN THE ELDERLY IN HOSPITAL

According to the 2007–2008 Australian Institute of Health and Welfare survey,⁵ about 4.4% of Australians have been diagnosed with diabetes at some time in their lives and of those with diabetes, 43% were aged 65 years old or more. Kagansky⁶ found 5.2% of elderly patients aged 70 years or older in hospital had documented hypoglycaemia

and 6.4% of patients with diabetes aged above 60 years had at least one episode of hypoglycaemia during their hospital admission.⁷

CLINICAL MANIFESTATIONS

Clinical manifestations of hypoglycaemia refer to signs and symptoms that people may have when their blood glucose levels drop. The signs and symptoms of hypoglycaemia for people with diabetes fall into two categories: neurogenic (autonomic) symptoms and neuroglycopenic symptoms.⁸ Neurogenic symptoms are triggered by a falling blood glucose level, which can lead to shakiness, trembling, anxiety, nervousness, palpitations, clamminess and sweating, dry mouth, hunger, pallor and pupil dilation. Neurogenic symptoms are activated by the autonomic nervous system and catecholamines are released from the adrenal medullae and acetylcholine from postsynaptic sympathetic nerve endings.⁸ Neuroglycopenic symptoms occur due to insufficient glucose supplies to the brain. The symptoms include 'abnormal mental function, irritability, confusion, difficulty in thinking and speaking, ataxia, paresthesias, headaches, stupor, seizures, coma or even death if untreated'.⁸

Hypoglycaemic symptoms can be age-specific and people at both ends of the age spectrum are most vulnerable to the effects of hypoglycaemia. Neuroglycopenic symptoms (such as lack of coordination, confusion, behavioural change and dizziness), and autonomic symptoms (such as trembling, sweating, pounding heart and hunger) were reported in children.⁹ In contrast to children, older people often present with other health conditions, which may affect their experience of hypoglycaemia. Unsteadiness, lightheadedness, poor concentration, trembling and sweating were the most frequently reported intense hypoglycaemic symptoms among the elderly.¹⁰

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HYPOGLYCAEMIA AND FALLS IN THE ELDERLY

The literature describing the relationship between falls and hypoglycaemia in older people^{11,12} noted that there was an increased risk for the insulin-treated patients to fall during a hypoglycaemic episode.

The risk of falls in elderly patients is the highest among patients with orthostasis, depressive symptoms, impairments in cognition, vision, balance, gait or muscle strength.¹³ Use of four or more prescription medications increases the risks of suffering side effects of medications such as hypoglycaemia and geriatric syndromes such as falls.¹⁴

Tight glycaemic control increases the risk of hypoglycaemia, which is associated with increased risk of falls in the elderly.¹⁵ Schwartz et al.¹⁶ also found low HbA_{1c} levels were associated with the risk of falls in the elderly who were using insulin therapy. It is understood that intensive insulin therapy can result in increased hypoglycaemic events. Therefore, diabetes treatment and glycaemic control for the elderly should be individualised and achievement of HbA_{1c} targets must be balanced against risk of severe hypoglycaemia. According to the Australian Diabetes Society,¹⁷ older people who have longer duration of diabetes, co-morbidities and who are at risk of severe hypoglycaemia and hypoglycaemia unawareness, can set their glycaemic target at 8%.

CAUSES AND RISK FACTORS OF HYPOGLYCAEMIA

Greco et al.¹⁸ examined the causes of severe hypoglycaemia in older patients with type 2 diabetes admitted to hospital. It was common that the energy intake of this age group was reduced due to a lack of appetite, missed meals, inability to eat, nutrient loss from vomiting or diarrhoea, which coexisted with other illness. The incidence of severe hypoglycaemia was also related to medication error. In addition, the Australian Diabetes Society¹⁹ also identified that those people who have a history of severe hypoglycaemia (especially over recent months), reduced hypoglycaemia awareness, a lower HbA_{1c} level and a longer duration of diabetes are at higher risk of severe hypoglycaemia.

The risk factors for developing severe hypoglycaemia in the older people using insulin or sulfonylureas were identified by Shorr et al.²⁰ as advanced age, recent hospitalisation, black

race, and use of more than 5 medications. In line with the finding of Shorr et al.²⁰ Greco et al.¹⁸ also identified advanced age and polypharmacy as risk factors of hypoglycaemia. Furthermore, it was found by Greco et al.¹⁸ that the elderly patients with a heavy burden of co-morbidity under tight glycaemic control therapy such as those who were treated with a long-acting sulfonylurea, were more likely to have severe hypoglycaemia, possibly due to impaired hepatic and renal function which was prominent in the older people with type 2 diabetes.

HYPOGLYCAEMIA AND MORTALITY RISK

Hypoglycaemia in the elderly hospitalised patients was associated with a two-fold increased mortality during hospitalisation and 3-month follow up.⁶ In particular, hypoglycaemia was found to be associated with increased risk of in-hospital death in patients with acute myocardial infarction.²¹ Yang et al.²² found those patients who were admitted to hospital with acute myocardial infarction and were also categorised into the hypoglycaemia group have a higher in-hospital and 3-year mortality rate than the hyperglycaemia group. Additionally, Svensson et al.⁷ showed hypoglycaemia in patients with type 2 diabetes and acute coronary events were associated with increased 2 year all-cause mortality risk. In summary, depending on the underlying cardiovascular risk of an individual patient, a personalised approach could be suggested to maximise the benefits and minimise the harm of their treatments.²³

HEALTH-RELATED QUALITY OF LIFE IN THE ELDERLY WITH DIABETES

In Australia, a person of 65 years age is expected to live on average a further 15 to 19 years.²⁴ It is important for health care professionals to consider how the elderly live with their diabetes and maximise their health-related quality of life.

To reduce their risk of developing a diabetes-related complication and maximise their health-related quality of life, optimal glycaemic control should be achieved in the elderly, as tight glycaemic control could limit the risk of vascular complications among people with diabetes.² However, the risk of hypoglycaemia for those receiving tight glycaemic control therapy also increased.²⁵ Hypoglycaemia is a common side-effect for people with diabetes receiving treatments with insulin and/or sulfonylureas²⁶ and it also has negative effects on people's quality of life. Williams et

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al²⁷ reported patients who had type 2 diabetes and were treated with oral hypoglycaemic agents experiencing hypoglycaemic symptoms were more likely to have lower health-related quality of life (HRQL) scores. Those patients who experienced low blood glucose levels also reported increased pain/discomfort and anxiety/depression, as well as 'some problems walking about' and 'some problems performing usual activities'.²⁷ In addition, the association between symptoms of hypoglycaemia and lower HRQL scores was identified by Pollack et al.²⁸

Severe hypoglycaemia compromises the health-related quality of life among older people who receive treatment for their diabetes. Porne et al.²⁹ found 10% of 2101 older people aged 65 years or above with type 2 diabetes who were involved in their study experienced severe hypoglycaemia during a year's period. Additionally, hypoglycaemic episodes were reported more frequently in those who receive insulin treatment than those without insulin treatment. In summary, strict glycaemic control is more likely to reduce the risk of vascular complications in people with diabetes in the long term, but it increases the risk of hypoglycaemia or even severe hypoglycaemia in the elderly. Fear of hypoglycaemia was also common in people with diabetes, which was identified in the literature of Wild et al.³⁰ Its negative impacts in diabetes management and people's quality of life cannot be underestimated. 'Long-lasting severe hypoglycaemia' can lead to 'transient and even permanent cerebral damage'.³¹ Therefore, the safety in this older age group should be carefully considered and their treatment plans should be individualised. For those 'young old' who are independent, mentally alert and able to sufficiently perform their routine daily activities, tight glycaemic control may be beneficial for them to prevent long-term complications and to maximise their health-related quality of life. In contrast, for those 'old old' who are frail and dependent, the benefit of tight glycaemic control to prevent long-term diabetes complications should be weighed against the older people's life expectancy and the risk of hypoglycaemia induced co-morbidities such as falls and acute myocardial infarction.

Furthermore, Porne et al.²⁹ also suggested the risk of developing long-term complications should be weighed against the patient's life expectancy, as it found 15% of patients with type 2 diabetes aged 80 years or above had a

recent diagnosis of diabetes (less than 5 years). As tight glycaemic control increases the risk of hypoglycaemia in the older people and may be related to falls or cardiac problems, Porne et al.²⁹ suggested the glycaemic control target for people aged 80 years or above, especially those frail and dependent, should be set higher than the younger patients.

As intensive insulin therapy increases the risk of hypoglycaemia²⁵ and is related to reduced health-related quality of life according to previous findings, health care professionals may choose not to initiate insulin treatment for the elderly. Interestingly, Reza et al.³² found that insulin therapy improved well-being for the elderly aged over 65 years old with type 2 diabetes and was not associated with a high risk of hypoglycaemia. In the study of Reza et al.³² 30 people commenced insulin treatment compared to 10 people who remained on oral hypoglycaemic agents. Improvements in mental health, vitality and treatment satisfaction showed in the insulin group. Unfortunately, the evidence was not strong enough due to the small sample.

Although it's commonly believed hypoglycaemia is associated with low HRQL scores, the study of Rodriguez-Pascual et al.³³ found worsening HRQL was not related to metabolic control. The study was conducted in a group of 112 people aged 65 years or more with type 2 diabetes. Interestingly, it found there was a strong relationship between poor HRQL and functional dependence, cognitive decline and depression, but not hypoglycaemia. Potentially the issue would be a fall or acute myocardial infarction induced by hypoglycaemia, which resulted in an increase in functional dependence, cognitive decline or depression.^{34,35}

PREVENTION OF HYPOGLYCAEMIA IN THE HOSPITAL

To reduce the incidence of hypoglycaemia related medical issues and decreased quality of life, prevention of hypoglycaemia is the key. In the hospital, nurses, doctors and other health care professionals should work as a team and develop systemic prevention strategies to minimise the occurrence of hypoglycaemia by³¹:

- 'recognising precipitating factors or triggering events',
- 'ordering appropriate scheduled insulin or insulin secretagogues',
- 'monitoring blood glucose at the

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bedside’,

- ‘educating patients, family and friends, and staff about symptom recognition and appropriate treatment’,
- ‘providing appropriate nutritional requirements’,
- ‘applying systems for eliminating or reducing medication and treatment errors in hospitalised patients’.³¹

It is important to educate patients, caregivers and health care professionals to recognise precipitating factors such as the inadequate timing of meals and administration of insulin or insulin secretagogues, patients with renal insufficiency or adrenal insufficiency. Insulin should be scheduled according to its action, for example, administer bolus insulin with each meal or not long after a meal. Carbohydrate food should be spread evenly with each meal. Protocols should be implemented and systems should be applied to minimise prescribing errors.³¹ This long list of preventive strategies requires detailed and ongoing instruction from diabetes educators. One of the roles of the diabetes educator is to incorporate all of the instructions from all health care professionals into a self-management plan for patients.³⁶

DIABETES EDUCATION FOR THE ELDERLY

Education plays an important role in diabetes self management in the elderly, including hypoglycaemia management.³⁷ Different types of educational programs have been established to improve diabetes management in the elderly. One of the examples is the continuing interactive educational model involving group discussions and cultural activities such as dining out together.³⁸ This model showed increased knowledge of diabetes care and improved metabolic control in a group of 148 patients aged 60 years or above over a period of 5 years follow-up. It also showed the rate of hospital emergency admission due to diabetic complications in those who participated in the program was decreased.

Positive effects of educational workshops in diabetes self-management were also demonstrated by Perman et al.³⁹ The study involved 1730 elderly patients older than 64 years with type 2 diabetes and it found those attending the self-management educational workshops had 33% lower mortality rate at 6 years of follow-up than those who did not attend.

However, education can be more complex for the advanced age group due to high prevalence of co-morbidities,³⁹ which increases the need for education in this group. Therefore, teaching methods should be specific to the older population with impaired physical and cognitive function.³⁷

Furthermore, Sinclair⁴⁰ suggested an educational program should focus on detecting and treating hypoglycaemia. As older people are vulnerable to hypoglycaemia and many of them cannot treat hypoglycaemia themselves, advice should also be given to other people such as caregivers on how to recognise and manage cases of hypoglycaemia.⁴⁰ Tessier and Lassmann-Vague³⁷ also agreed it was crucial to involve caregivers in the educational process, particularly for those cognitively impaired older people.

To achieve optimal effects of diabetes self-management education in older people, educational sessions should be individualised.⁴¹ Medical issues such as the duration of diabetes, presence of complications and other co-morbidities, English proficiency, diabetes-related knowledge, physical and cognitive ability to learn new skills and quality of life should be considered.⁴¹ To meet the needs of the elderly, it was generally recommended that simple material and written information should be provided; a black font with type size more than 12 points on white paper should be used due to possible visual impairment; a family member or friend be invited to educational sessions.⁴¹ In addition, the recognition of hypoglycaemic symptoms and the importance of monitoring blood glucose levels should be emphasised in the older people as the ability of the elderly to recognise hypoglycaemia can be decreased. For the older people with diabetes who are able to drive a vehicle, it is important for them to monitor their blood glucose levels prior to driving.⁴¹

CONCLUSION

In conclusion, older people with diabetes can experience different symptoms of hypoglycaemia as they often present with other health conditions. Unsteadiness, lightheadedness, poor concentration, trembling and sweating are common hypoglycaemic symptoms among the elderly. These symptoms may increase their risks of falling. Tight glycaemic control can increase the incidence of hypoglycaemia, which can affect the health-related quality of life in the older people. Hypoglycae-

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mia is also associated with increased mortality risk in the older population, such as acute myocardial infarction and ischemic heart disease. Intensive glycaemic control therapy should be used cautiously in this vulnerable group.

The prevalence of hypoglycaemia in the elderly in hospital ranges from 5.2% to 6.4%. Tight glycaemic control can be associated with hypoglycaemia, which can have negative impacts on the health-related quality of life in the elderly, such as falls and cognitive decline. Glycaemic targets for the elderly should be individualised and balanced against severe hypoglycaemia and other co-morbidities. Prevention of hypoglycaemia plays a key role in reducing the incidence of hypoglycaemia and its related medical issues.

In the hospital, nurses, doctors and other health care professionals should work as a team and develop systematic prevention strategies to minimise the occurrence of hypoglycaemia. Education on hypoglycaemia management is essential for the elderly and their caregivers. However, educational programs should be individualised to meet the learning needs of the older people, thus the optimal effects of diabetes self-management can be achieved.

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