Epidemiology of new-onset diabetes mellitus after dialysis

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Abstract

Introduction

Diabetic nephropathy is the leading cause of end-stage renal disease in patients undergoing dialysis. Most studies evaluate the association between pre-existing diabetes mellitus, but very few focus on new-onset diabetes mellitus after dialysis. Chronic dialysis patients are often older and have multiple comorbidities, including cardiovascular diseases and pancreatic disorder. In addition, these patients have been found to be in a state of chronic inflammation. These characteristics have been associated with the development of insulin resistance and diabetes. Herein, we critically review the epidemiology, risk factors and mortality of new-onset diabetes mellitus after dialysis.

Conclusion

The dialysis population has a higher incidence of new-onset diabetes mellitus and a greater risk of mortality than the general population. In addition, the post-transplant incidence of diabetes mellitus, which always occurs the first year after transplant, is much higher than the pre-transplant incidence. However, dialysis modality does not appear to be associated with new-onset diabetes mellitus after dialysis and post-transplant. The independent predictors of new-onset diabetes mellitus are old age, cardiovascular comorbidity and dyslipidemia. Other possible contributing factors are inflammation and use of some commonly prescribed drugs for cardiovascular disease, such as statin. Physicians may need to pay more attention to the possibility of new-onset diabetes mellitus when treating high-risk patients undergoing dialysis.

Discussion

The authors have referenced some of their own studies in this review. These referenced studies have been conducted in accordance with the Declaration of Helsinki (1964) and the protocols of these studies have been approved by the relevant ethics committees related to the institution in which they were performed. All human subjects, in these referenced studies, gave informed consent to participate in these studies.

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Several studies have reported that NODM occurs among patients receiving dialysis at rates greater than in the general population. In Taiwan, the incidence of DM in the general population in the web page, the incidence rate for DM in the general population in the US fluctuated around 0.5%-0.9% per year from 2000 to 2009. Using data from the United States Renal Data System from January 2000 to December 2001 to study patients aged 18-80 years old in a three-year follow up study, Salifu et al. found the incidence of NODM after dialysis to be 20 per 1,000 patient-years and its prevalence to be 4.6% in the first year after initiation of dialysis.

In Taiwan, the incidence of DM in the general population from 2000 to 2009 was 0.7%–0.9% per year. In addition, the incidence rate for new-onset diabetes mellitus after dialysis is much higher, occurring the first year after transplant, is 2-15 times the incidence of NODM after dialysis. OA Nephrology 2013 Jul 01;1(2):11. This critical review focuses on the epidemiology and risk factors of NODM after dialysis.
Still there are conflicting data regarding the relation between glycaemic load and the development of NODM. For example, although high intake of foods with high glycaemic loads has been found to increase the risk of type 2 DM in Chinese, Mosdol et al. did not find such an association in the Whitehall II study. Pure glucose has the highest glycaemic index, but few long-term follow-up studies have investigated the glucose load and the risk of DM, especially in patients with ESRD.

Both patients on HD and those on PD are associated with similar high incidence of NODM. One of our studies found no significant difference in percentage of those developing NODM after the initiation of dialysis between patients receiving HD (12.80%) and patients receiving PD (12.20%) (PD to HD hazard ratio of NODM: 0.94, 95% CI 0.83–1.06). This finding was similar to that reported by Woodward et al. in a study following wait-listed transplanted renal allograft recipients. They observed the different type of dialysis modality made a noticeable difference in the incidence of NODM two years pre-transplant. During the two-year pre-transplant period, 10.7% of PD patients and 12.7% of HD patients, who were previously non-diabetic, developed NODM. The post-transplant incidence of DM was noticeably higher than the pre-transplant values. During the first year post-transplant, 13.2% and 14.9% of the PD and HD patients, respectively, developed NODM. After multivariate adjustment, there was no significant difference between PD and HD patients who developed NODM during post-transplant period in their study.

**Risk factors and possible mechanisms**

Although the underlying mechanism for the relationship between ESRD dialysis and NODM are not fully understood, the factors associated with ESRD dialysis, including being older, having histological abnormalities and dysfunction in the pancreas, having CVD, including stroke and heart failure, and in a state of chronic inflammation, can induce insulin resistance and the development of type 2 DM.

Szeto et al. reported significant correlations between plasma glucose levels and age, Charlson comorbidity score, and serum C-reactive protein level in patients receiving PD. In our analysis using Taiwan’s National Health Insurance Research Database, being older, having hypertension, congestive heart failure, coronary artery disease and a cerebrovascular accident and dyslipidaemia were found to be independent risk factors for NODM in dialysis patients. The relationship between CVD and NODM might explain the presence of underlying inflammation. Dyslipidaemia and vascular inflammation result in endothelial dysfunction and atherosclerosis. Elevated values of circulatory makers such as interleukin-6 and high sensitivity C-reactive protein commonly accompany CVD. Vascular inflammation and endothelial dysfunction may also be associated with an increased risk of developing DM. In addition, use of some commonly prescribed drugs for CVD, such as statin, might also lead to the development of dysglycaemia, as many meta-analyses report an association between statin use and increased risk for incident DM.

**Impact on mortality**

NODM has been associated with higher mortality in patients on maintenance dialysis. Increased plasma glucose levels have been found to be an independent risk factor for mortality in PD patients, even in those with a minor degree of hyperglycaemia. Szeto et al. found actuarial survival rates at 36 months for patients with fasting plasma glucose levels.
Critical review


References