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Original Article

The rate of progression of type 2 diabetes mellitus to end stage renal disease – A single centred retrospective study from Malaysia

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ABSTRACT

Introduction: In Malaysia, 61% of dialysis cases are secondary to diabetes. To date, we are still lacking of data on the rate of progression of type 2 diabetes mellitus (T2DM) to end stage renal disease (ESRD) in Malaysia.
Materials and methods: This was a retrospective study conducted at nephrology unit of a tertiary hospital in Kedah. All diabetic ESRD patients who fulfilled the inclusion criteria were identified and recruited for analysis.
Results: The mean duration of DM to ESRD was found to be 14.37 ± 4.42 years. Mean duration for the onset of diabetic nephropathy was 8.73 ± 3.37 years. There was a relative short duration from diabetic nephropathy to ESRD noted, which was 5.63 ± 2.06 years. The mean duration of DM to ESRD for patients receiving RAAS blocker was found to be 18.23 ± 2.38 years as compared to 11.41 ± 2.94 years for those who did not (95% CI: -0.64 to -2.46). For different type of RAAS blockers, namely *ACE* inhibitor and angiotensin receptor blocker (ARB), there was no significant difference observed pertaining to mean duration of DM to ESRD; 17.89 ± 1.97 years for ACEi and 19.00 ± 4.16 years for ARB (95% CI: -4.74 to 2.52).
Discussion: Time frame from diabetic nephropathy to ESRF among Malaysian population was shorter as compared to findings from other countries with an average period of 15 to 25 years. RAAS blockers should be initiated early in diabetic patients.

1. Introduction

Diabetes mellitus is a chronic metabolic disorder with a high potential of microvascular and macrovascular complications especially in those marginally or poorly controlled patients [1]. Diabetic patients are likely to develop kidney disease due to microvascular complication and about 10 to 40% of type 2 diabetic patients will eventually suffer from kidney failure [2]. There is a continuous rise in the incidence of end stage renal disease among diabetic patients predominantly in type 2 diabetes mellitus (T2DM). According to United States Renal Data System, diabetes accounting for nearly 44% of new kidney failure even if diabetes is controlled [3]. Recent National Health and Morbidity Survey (NHMS) [10] 2015 by Ministry of Health Malaysia revealed that overall prevalence of diabetes in patient age ≥ 18 years old is 17.5%, accounting for 3.3 million of its population. The 21st report of Malaysian Dialysis and Transplant Registry [11] reported that 61% of end stage renal disease (ESRD) among Malaysian population was caused by diabetes mellitus. End stage renal disease commences after the diagnosis of type 2 diabetes mellitus in a varying duration. According to published literatures ESRD has been reported in diabetic patients after a disease duration of 20 years and the main cause is diabetic nephropathy [4–6]. To date, we are still lacking information on the rate of progression of T2DM to ESRD in Asian population especially in Malaysia since it was reported that ethnicity play a significant role in glomerular filtration drop rate [7–9].

The present study aimed to examine the rate of progression of T2DM to ESRD in Malaysia population. Besides, it also investigated the differences in rate of progression of T2DM to ESRD between patients receiving Renal-Angiotensin-Angiotensinogen-System (RAAS) blocker at time of diagnosis of T2DM and those who did not as well as the costs incurred. It also explored the prescribing trends of antihypertensive among T2DM patients.

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2. Methods

2.1. Study setting and data acquisition

This was a single centred, retrospective study involving all patients receiving renal replacement therapy in nephrology unit of Sultanah Bahiyah Hospital, Alor Setar, Kedah, Malaysia; a tertiary referral hospital. The study methodological flow chart is shown in Fig. 1. Only diabetic end stage renal disease patients, past medical history of T2DM and Malaysian were enrolled. Patient's demographic data, age of onset of diabetes, date of onset of diabetic nephropathy and the date of initiation of renal replacement therapy were retrieved from patients' medical records which were traced from the computerized clinical information system. These data was then transferred into the case report form. The main reasons for exclusion were missing or incomplete data and documented as type 1 diabetes mellitus.

2.2. Ethical considerations

The study was performed in accordance to the principles of the Declaration of Helsinki, as revised in Washington in 2013. This study attained approval from the Medical Research Ethics Committee (MREC), ministry of Health Malaysia (NMRR-15-2014-28595-IIR). Institutional approval was obtained from the director of Sultanah Bahiyah Hospital. All data collected were kept strictly confidential, and no identifiable information was collected.

2.3. Statistical methods

The data were computed and analysed using Statistical Package for Social Sciences (SPSS version 23, SPSS Inc., Chicago, II, USA). Descriptive statistics were used to summarize the baseline characteristics. χ^2 test was used to analyze dichotomous data. Continuous variables were analyzed for normality using Shapiro-Wilk. Since p values generated from Shapiro-Wilk test for all continuous variables were more than 0.05, hence parametric tests were used for data analysis. Independent *t*-test was use for between group comparisons while one way ANOVA was used for more than two group comparisons and followed by Turkey HSD for post hoc analysis. Differences are considered statistically significant if 2-tailed tests estimated at a p value less than 0.05.

2.4. Pharmacoeconomic analysis

For cost effectiveness analysis part, incremental cost effective ratio (ICER) was performed by using the following formula:

$$\text{ICER} = \frac{\text{Cost(new)} - \text{Cost (old)}}{\text{Effectiveness (new)} - \text{Effectiveness (old)}}$$

This analysis was done to compare the ICER between patients receiving RAAS blocker at time of T2DM diagnosis and patients who did not. The end point use for this analysis was the differences in duration from T2DM to ESRD between these two groups of patients, which is the life years gained.

3. Results

3.1. Demographic data

A total of 183 ESRD patients were screened for eligibility to be enrolled into the study. 153 were excluded due to incomplete data and not fulfilling the inclusion criteria. The demographic characteristics of patients are summarized in Table 1. All patients were adults older than 18 years old and there was an equal gender distribution. The three main ethnics in Malaysia are the Malay, the Chinese and the Indian. However, there was no Indian patient captured in this study. All patients enrolled into this study were having a normal baseline serum creatinine level at time of T2DM diagnosis, which was a median of 68 (IQR: 24) μmol/L.

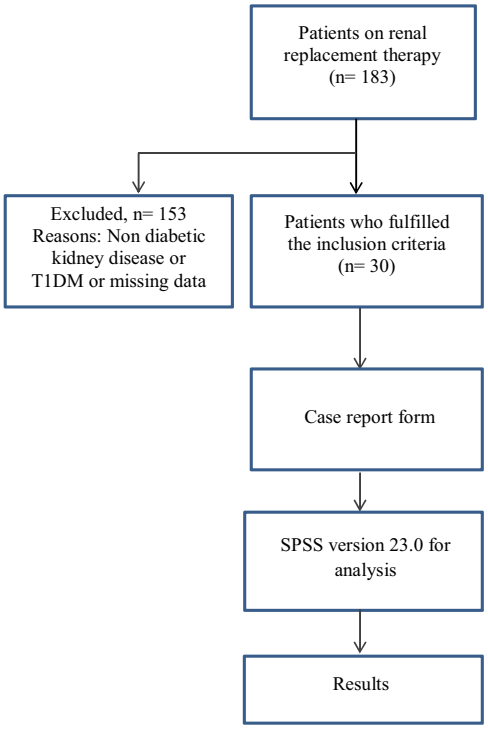

Fig. 1. Methodology Flow Chart.

Table 1
Baseline Characteristics of the Patients.

	Total (N = 30)	P-Value[a]
Age – year[c]	59.00 (13)	
Weight – kg[b]	67.55 ± 11.70	
Male sex – no. (%)	15 (50.0)	
Baseline serum creatinine- μmol/L[c]	68.00 (24)	
Race or ethnic background – no. (%)[d]		
Malay	24 (80.0)	0.001
Chinese	6 (20.0)	
Co-morbidity - no. (%)		
Hypertension	16 (51.6)	
Hypertension & dyslipidaemia	7 (22.6)	0.002
Ischaemic heart disease	7 (22.6)	
Others	1 (3.2)	
Social history – no. (%)		
Smoker	11 (35.5)	
Family history - no. (%)		
Diabetes	6 (19.4)	
Hypertension	8 (25.8)	0.022
Diabetes & hypertension	2 (6.5)	
Diabetes & kidney disease	1 (3.2)	
Diabetes, hypertension & kidney disease	1 (3.2)	
RAAS blocker at time of diabetes - no. (%)		
Yes	13 (41.2)	

RAAS blocker- renal angiotensin angiotensinogen system blocker.
[a] Chi square test.
[b] Mean ± SD.
[c] Median (IQR).
[d] Race or ethnic background was reported in the case note.

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