

Optimising care: Impact of regular nephrologist appointments on clinical outcome for chronic kidney disease patients in primary care

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ABSTRACT

Introduction: The rise in the cases of chronic kidney disease (CKD) with the increasing prevalence of non-communicable diseases such as type 2 diabetes mellitus and hypertension is a major public health concern in Malaysia. This results in the many cases of chronic kidney disease being managed in primary healthcare clinics. This study examines the pre- and post-clinical outcomes of scheduled nephrologist visits on CKD patients in a primary health care clinic in Ipoh, Perak.

Materials and Methods: This is a retrospective cross-sectional study reviewing the medical records of patients seen by visiting nephrologists from January 2019 to December 2021 in Greentown Health Clinic. The study population are patients with CKD stage 3b, 4 and 5 who are followed up in Greentown Health Clinic. Universal sampling was done, a total of 87 patients reviewed at least once by the visiting nephrologist and with retrievable medical records were included in the study. Those whose medical records were irretrievable were excluded. Blood pressure, urine protein, fasting blood sugar (FBS), glycated haemoglobin (HbA1c), serum creatinine, eGFR and fasting lipid profile (FLP) pre- and post-visits were collected by reviewing patient medical records and laboratory results. The results were then analysed and compared using SPSS version 26.

Results: The median age of patients in this study was 66 years of age, the majority were male patients (54%) and Malay ethnicity (62.1%). Absence of urine microalbuminuria pre and post referral remain the same (n = 11). During pre-nephrologist visits, a higher percentage of patients exhibited moderate (30-300 mg/g) and severe (>300 mg/g) increase in urine albuminuria (15.7% and 7.2%, respectively) compared to the post-referral period. In patients with significant urine protein pre-referral, patient group with urine protein 3+ showed the highest increment of 30.1% (n = 22), in comparison to 19.3% (n = 16) observed during pre-referral. Statistically significant clinical outcomes between pre- and post-referral to the nephrologist include reduction of systolic blood pressure [141±15 mmHg versus 135 ±12 mmHg, p = 0.001] and diastolic blood pressure [median = 80 mmHg (IQR: 10) versus median=71 mmHg (IQR: 17), p < 0.001]. Similarly, total cholesterol [median = 4.4 mmol/L (IQR: 1.4) versus median = 4.0 mmol/L (IQR: 1.5, p = 0.001] and LDL [median = 2.5 mmol/L (IQR: 1.2) versus median = 2.2 mmol/L (IQR: 1.2), p < 0.001] exhibited statistically significant differences between pre- and post-referral.

However, HDL remained unchanged and other outcome variables showed no significant differences.

Conclusion: Incorporating nephrologist visits in primary care seems to have positive impact towards patient clinical outcomes. Results shown in this study can aid other primary care clinics in the decision to initiate nephrologist services in the primary care setting as a multidisciplinary approach to managing CKD patients.

KEYWORDS:

Nephrologist, primary care, chronic kidney disease, blood pressure, cholesterol

INTRODUCTION

Chronic kidney disease (CKD) is a leading public health problem and burden on the healthcare system. The global estimated prevalence of CKD is 13.4% and patients with end-stage kidney disease (ESKD) needing renal replacement therapy are estimated to be between 4.902 and 7.083 million.¹ In Malaysia, a population-based study in 2011 reported that 9.1% of Malaysians have CKD² however, by 2018 this figure has rapidly increased to 15.48%.³ The prevalence of CKD is expected to further rise in the future due to the increasing prevalence of diabetes mellitus, hypertension and the ageing population in Malaysia.⁴ A time-series analysis published in 2017 projected the estimated incidence of new dialysis patients in Malaysia from 10,208 in the year 2020 to 19,418 in 2040. Meanwhile, the prevalence of ESKD is estimated to be 51,269 in 2020 and 106,249 in 2040.⁵ This is quite worrying as managing CKD will have a significant socioeconomic burden on the national healthcare system.

In Malaysia, the majority of CKD patients are managed at primary healthcare centres under the Ministry of Health (MOH). Early detection of CKD and timely intervention are two important strategies in retarding the disease progression.⁴ Studies have shown that early referral to a nephrologist can be lifesaving and also improves patients' quality of life.⁶

An established patient-primary care practitioner-nephrologist relationship can ease the transition to renal replacement therapy in future. One such intervention by MOH Malaysia is the National Action Plan for Healthy Kidneys (ACT-KID) which was developed in 2018. The main

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aim of ACT-KID is to prevent or delay the onset of CKD, improve its management, and establish multidisciplinary collaboration between primary care and nephrologists. These outreach services were made available at 17 primary care clinics nationwide, with Greentown Health Clinic the only centre in Perak state providing this service.⁴

A retrospective study was done in 2020 at Greentown Health Clinic, to evaluate the outcome of patients with CKD under the visiting nephrologists' follow-up.⁷ However, this study only had a small sample size of 35 patients.

The objectives of this study are to look at the impact of scheduled nephrologist visits on the clinical outcomes of CKD patients in primary care by comparing blood pressure readings, urine albumin and blood investigations (FBS, HbA1C, RP and FLP) pre- and post-referral to visiting nephrologist.

MATERIALS AND METHODS

Study Design

This study is a retrospective cross-sectional study by reviewing the medical records of patients seen by visiting nephrologists from January 2019 to December 2021.

Study Setting and Population

This study was conducted in Greentown Health Clinic, a government health clinic located in Ipoh, Perak. There are about 4000 diabetics and 5200 hypertensive patients on follow up in this clinic with two Family Medicine Specialist. The study population are patients with CKD stage 3b, 4 and 5 who are followed up in Greentown Health Clinic. Underlying comorbidities include hypertension, diabetes, ischemic heart disease and other renal related conditions. The role of the family medicine specialist is to optimise blood pressures, sugar and lipid levels by various measures. These would include lifestyle measures of dietary and exercise counselling, regular diabetes self-management education group classes to empower patients to control their diabetes, medication optimisation and pre dialysis counselling where appropriate. Patients seen in the visiting nephrologist clinic are all seen by or co-managed with a family medicine specialist to optimise their disease control at the primary care level in hope to slow down kidney disease progression prior to escalating care to the visiting nephrologist.

Inclusion and Exclusion Criteria

All patients who have been seen by visiting nephrologist at least once were included in the study. Patients whose medical records were not retrievable were excluded from the study.

Sample Size and Sampling Method

Universal sampling was done in this study. The number of patients referred to the visiting nephrologist in the year 2020 has reduced in comparison to 2019 due to the COVID-19 pandemic movement control order. An average of 2 to 6 patients are seen by the visiting nephrologist in a month. Taking into consideration that the number of patients attending the clinic is reduced, all patients who were eligible were included in the study.

A total of 94 patients were seen at least once by visiting a nephrologist at Greentown Health Clinic during the study period. Seven patients were excluded as their medical records were not found. A total of 87 patients were included in the final analysis.

Data Collection

The medical records of 87 CKD patients were reviewed retrospectively. CKD definition in this study is defined as eGFR <60 ml/min/1.73m² present for more than 3 months with or without evidence of kidney damage.¹⁰ The variables for comparison in this study include pre and post-visit systolic blood pressure (SBP) and diastolic blood pressure (DBP), urine protein, fasting blood sugar (FBS), glycated haemoglobin (HbA1c), serum creatinine, eGFR and fasting lipid profile (FLP). The baseline blood investigations used will be the latest available investigations taken before the nephrologist visits. Investigations after nephrologist visit will be the earliest investigations taken after nephrologist visit.

The variables were compared and analysed using Statistical Package for Social Sciences (SPSS) version 26. Data that were normally distributed were reported as mean and standard deviation (SD), and those not normally distributed were reported as median and interquartile range (IQR). Paired T-test was used for the analysis of normally distributed variables. Wilcoxon signed-rank test was used for the analysis of non-normally distributed data. A value of $p < 0.05$ is considered statistically significant (confidence interval 95%).

RESULTS

Among the 87 patients analysed, the median age was 66 years (range 31 to 90 years). There were more male patients (54%) than female (46%) with the majority being Malays (62.1%). Eighty two (94.2%) had hypertension and 79 (90.8%) of the patients were non-smokers. (Table I).

Referring to the urine profiles of 83 patients before referral, 13.3% (n = 11) exhibited no signs of albuminuria. Conversely, post-referral, 15.1% (n = 11) of the 73 patients showed an absence of albuminuria. During pre-nephrologist visits, a higher percentage of patients exhibited moderate (30 300 mg/g) and severe (> 300 mg/g) increase in urine albuminuria (15.7% and 7.2%, respectively) compared to the post-referral period. In patients with significant urine protein pre-referral, patient group with urine protein 3+ showed the highest increment of 30.1% (n = 22), in comparison to 19.3% (n = 16) observed during the pre-referral (Table II).

The comparison of clinical outcomes between pre- and post-referral to the nephrologist reveals statistically significant differences in the reduction of systolic blood pressure [141±15 mmHg versus 135 ±12 mmHg, $p = 0.001$] and diastolic blood pressure [median = 80 mmHg (IQR: 10) versus median=71 mmHg (IQR: 17), $p < 0.001$]. Similarly, total cholesterol [median = 4.4 mmol/L (IQR: 1.4) versus median = 4.0 mmol/L (IQR: 1.5, $p = 0.001$] and LDL [median = 2.5 mmol/L (IQR: 1.2) versus median = 2.2 mmol/L (IQR: 1.2), $p < 0.001$] exhibited statistically significant differences between pre- and post-referral. However, HDL remained unchanged and other

Table I: Characteristics of patients referred to visiting nephrologist

Patient demographics	Total (n=87)
Age in years, Median (IQR)	66 (16)
Gender, n (%)	
Male	47 (54.0)
Female	40 (46.0)
Ethnicity, n (%)	
Malay	54 (62.1)
Chinese	22 (25.3)
Indian	10 (11.5)
Others (Foreigner-Taiwanese)	1 (1.1)
Smoking, n (%)	
No	79 (90.8)
Yes	8 (9.2)
Comorbids (can be more than one)	
Hypertension	82 (94.2)
Diabetes	69 (79.3)
Hyperlipidaemia	65 (74.7)
Ischemic Heart Disease	12 (13.7)
Benign Prostate Hypertrophy	7 (7.8)
Gout	5 (5.7)
Renal calculi	2 (2.3)

Table II: Urine profile

	Pre-referral, n = 83 Frequency/%	Post-referral, n = 73 Frequency/%
Urine albuminuria		
Normal, < 30mg/g	11 (13.3)	11 (15.1)
Moderately increased, 30-300mg/g	13 (15.7)	6 (8.2)
Severely increased, >300 mg/g	6 (7.2)	4 (5.5)
Urine FEME		
Trace	3 (3.6)	4 (5.5)
1+	11 (13.3)	10 (13.7)
2+	23 (27.7)	16 (21.9)
3+	16 (19.3)	22 (30.1)

Table III: Clinical outcomes

Variables	n	Pre-referral median (IQR) or mean (SD)	n	Post-referral median (IQR) or mean (SD)	p-value
Systolic blood pressure (mmHg), mean (SD)	87	141 (15)	78	135 (12)	0.001#
Diastolic blood pressure (mmHg), median (IQR)	87	80 (10)	78	71 (17)	<0.001*
Creatinine (mmol/L), Median (IQR)	87	183.0 (92.0)	80	185.5 (134.0)	0.122*
eGFR (ml/min/1.73 m ²), median (IQR)	87	27.8 (19.5)	80	29.5 (21.6)	0.340*
Urine protein (normal), n(%)	83	11(13.3)	73	11(15.1)	>0.95^
HbA1c (%), median (IQR)	73	6.7 (2.3)	59	6.6 (2.1)	0.233*
FBS (mmol/L), median (IQR)	87	6.3 (2.9)	74	6.2 (2.8)	0.730*
Total cholesterol (mmol/L), Median (IQR)	87	4.4 (1.4)	72	4.0 (1.5)	0.001*
Triglyceride (mmol/L), Median (IQR)	87	1.5 (0.9)	72	1.4 (0.7)	0.062*
HDL (mmol/L), median (IQR)	87	1.1 (0.4)	72	1.1 (0.4)	0.006*
LDL (mmol/L), median (IQR)	87	2.5 (1.2)	72	2.2 (1.2)	<0.001*

Paired t-test with a mean difference of -5 (95% CI -7.77, -2.17)

* Wilcoxon signed-rank test

^ McNemar test- urine protein is re-categorized to normal (urine albuminuria < 30 mg/g) and abnormal (urine albuminuria 30 to 300mg/g, >300 mg/g, proteinuria trace/1+/2+/3+)

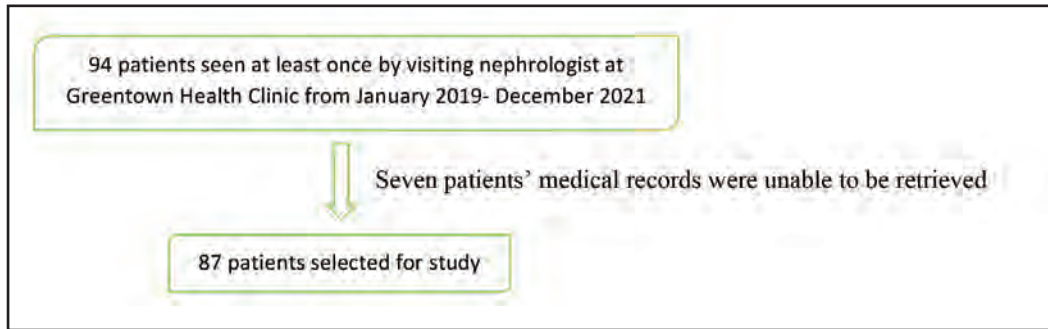


Fig. 1: Flow chart of sampling.

outcome variables showed no significant differences (Table III).

Post-referral data were missing in all variables as some patients defaulted follow-up visits. Several patients referred to the nephrology clinic in the tertiary centre did not have investigations ordered after their transfer out, while two patients were transferred to other local clinics.

DISCUSSION

The results of this 3-year retrospective study further amplify the results of the previous study done in 2020.⁷ We managed to include 87 patients in this study. Results which were consistently seen is the significant reduction in both systolic and diastolic blood pressure pre- and post-referral to nephrologist. This could be attributed to reinforcement on dietary changes and compliance to medication, optimisation of therapy and minimizing exposure to nephrotoxins that potentially lead to deterioration of renal function. The Clinical Practice Guidelines (CPG) on management of chronic kidney disease in 2018 targets blood pressure for patients with diabetic kidney disease to be $\leq 130/80$ mmHg.⁸ In this study, blood pressure post-nephrologist referral was reduced to a median of 135/71 mmHg.

Other significant biochemical improvements post-referral was the reduction in total cholesterol and LDL levels. The LDL- cholesterol, an important modifiable risk factor in the incidence of revascularizations, ischemic stroke, atherothrombotic process and cardiovascular death has also improved post-nephrologist referral. A mean reduction to 2.2 (IQR: 1.2) drastically reduces the risk of developing atherosclerotic events in patients with CKD, though the effects of treatment on the progression of CKD remain uncertain.⁹

Urine protein levels did not show significant improvement post-referral. This is expected as patients included in this study were patients with CKD stages 3b, 4 and 5 who have glomerular hyperfiltration, hypertrophy and sclerosis. Though there was no improvement in eGFR levels, it seems to have stabilized and the deterioration is lesser than expected for patients with CKD. The reduction in HbA1c was not significant but it is important to highlight the median levels of HbA1c pre-referral were 6.7, which reduced to 6.6 post-referral. This shows the majority of the patients had acceptable glycaemic control.

To our knowledge, this is a novel study in Malaysia to evaluate the impact of scheduled nephrologist visits among CKD patients in primary care and can be used as a comparison for future studies. In addition to improving patient care and outcome, these patients also had better collaboration between primary and tertiary care. All the positive findings from this study are very promising and further consolidates the importance to establish a multidisciplinary collaboration and community health approach to meet the needs of CKD patients, in line with the National Action Plan for Healthy Kidneys.⁴ Literature review on related or similar studies globally shows mixed results but prior contact with a nephrologist was not significantly associated with CKD progression, incidence of CVD or death.¹⁰⁻¹³

LIMITATIONS

This study had a small sample size over a span of 3 years. Covid restrictions and cancellation of appointments were one of the factors resulting in lesser referrals to visiting nephrologists. For this study, we defined investigations post-referral as the earliest investigations taken post nephrologist visit, hence, investigations are sometimes taken at the earliest at 1-month post-visit. However, HbA1c investigations should be taken 12 weeks after the initial test for comparison. In subsequent studies, we hope to have a larger sample, with standardized criteria for post-referral blood investigation schedules and follow-up visits. Furthermore, without controls, there is potential for bias and confounding factors in this study (e. g., effect of treatment and patient characteristics) which may affect the results beyond or independent of the care and management by nephrologist. Ideally, this should be an interventional study with controls, which we propose for future studies.

CONCLUSION

Nephrologists' visits to primary care seems beneficial and this study shows significant blood pressure reduction and cholesterol improvement among of chronic kidney disease (CKD) patients. This initiative should be expanded where feasible if there are adequate nephrologists available in tertiary centres for such visits.

Another important factor to be considered would be cost effectiveness of such an initiative, as it would be preferable if it's more cost effective than patients visiting them at the tertiary level. Additionally, tertiary referral of all identified

patients would lead to a non-sustainable overload of nephrology care resources. Nephrologist can help strengthen and assist family medicine specialists in primary care to co-manage patients with chronic kidney disease and further enhance multidisciplinary collaboration to meet the needs of CKD patients. We hope to have a multicentred, prospective study with a larger sample size in future with controls and standardized post-visit blood and urine investigation timings for a more robust study finding.

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REFERENCES

1. Lv JC, Zhang LX. Prevalence and disease burden of chronic kidney disease. *Adv Exp Med Biol* 2019; 1165: 3-15.
2. Institute for Public Health (IPH) 2011. National Health and Morbidity Survey 2011 (NHMS 2011). Vol. II: Non-Communicable Diseases.
3. Saminathan TA, Hooi LS, Mohd Yusoff M. et al. Prevalence of chronic kidney disease and its associated factors in Malaysia; findings from a nationwide population-based cross-sectional study. *BMC Nephrol* 21, 344 (2020).
4. Plan for Healthy Kidneys (ACT-KID) 2018-2025.de population-based cross-sectional study. *BMC Nephrol* 2020; 21(1): 344.
5. Bujang MA, Adnan TH, Hashim NH, Mohan K, Kim Liong A, Ahmad G, et al. Forecasting the incidence and prevalence of patients with end-stage renal disease in malaysia up to the year 2040. *Int J Nephrol* 2017; 2017: 2735296.
6. Diamantidis CJ, Powe NR, Jaar BG, Greer RC, Troll MU, Boulware LE. Primary care-specialist collaboration in the care of patients with chronic kidney disease. *Clin J Am Soc Nephrol* 2011; 6(2): 334-43.
7. Paranthaman V, Ridzuan MH. Scheduled Nephrologist Visit to Primary Care? You Gotta Be 'Kidney' Me. Perak State Health Department Technical Report 2021.
8. Management of Chronic Kidney Disease (second edition) 2018. Ministry of Health Malaysia. MOH/P/PAK/394.18(GU). Available from: on <http://www.moh.gov.my>
9. Haynes R, Lewis D, Emberson J, Reith C, Agodoa L, Cass A, et al. Effects of lowering LDL cholesterol on progression of kidney disease. *J Am Soc Nephrol* 2014; 25(8): 1825-33.
10. Ricardo AC, Roy JA, Tao K, Alper A, Chen J, Drawz PE, et al. Influence of Nephrologist Care on Management and Outcomes in Adults with Chronic Kidney Disease. *J Gen Intern Med* 2016; 31(1): 22-9.
11. Crews DC. Chronic Kidney Disease: A Place for Primary Care and Nephrology to Meet. *Journal of general internal medicine*. 2016; 31(1): 5-6.
12. Orlando LA, Owen WF, Matchar DB. Relationship between nephrologist care and progression of chronic kidney disease. *N C Med J* 2007; 68(1): 9-16.
13. Saudan P, Ponte B, Marangon N, Martinez C, Berchtold L, Jaques D, et al. Impact of superimposed nephrological care to guidelines-directed management by primary care physicians of patients with stable chronic kidney disease: a randomized controlled trial. *BMC Nephrol* 2020; 21(1): 128.