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Original Article

Renal replacement Therapy in Saskat chewan: A population based analysis

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Abstract

Aim: Chronic kidney disease is a critical condition with considerable public health implications. It affects a significant proportion of the general population and when progressive, has an increasing influence on morbidity and mortality. The main purpose of this study was to explore the distribution and trends of renal replacement therapy and vascular access practice patterns among Saskatchewan end stage renal disease patients.

Material and Method: This is a registry-based retrospective observational study. Prevalence of patient's on renal replacement therapy in the Canadian Organ Replacement Register who has information for renal replacement therapy from 2006 to 2016 in the province of Saskatchewan. The composite of demographics, mortality, type of renal replacement therapy, type of vascular access and important blood markers ranges were recorded among both haemodialysis and peritoneal dialysis patients.

Results: From 2006 through 2016, a total of 2103 patients with mean age of 69.52±13.2 initiated renal replacement therapy in Saskatchewan. Among those patients, over half of the patients were female (62%). Majority of the patients were Caucasians and Aboriginals. Nearly two third of them were overweight and obese. Less than half developed end stage renal diseases secondary to diabetes and 14.9% had a primary diagnosis of glomerulonephritis. At the end of 2015, prevalence of end-stage kidney disease patients was 1330 in the Saskatchewan. During 2006 to 2016, 72.3% received haemodialysis, 22.8% received peritoneal dialysis, and, catheter was the most frequently used dialysis access method (64.6%).

Conclusion: An increasing number of patients with advanced renal disease are being initiated on long-term dialysis every year. Haemodialysis and peritoneal dialysis are the two main types of dialysis provided under renal care programs. Alarmingly, in Saskatchewan, catheter was the most frequently used dialysis access method.

Keywords: End Stage Renal Disease; Renal Replacement Therapy; Vascular Access; Saskatchewan.

INTRODUCTION

End stage renal disease (ESRD) is a disorder associated with multiple complications. Some are a direct cause of the loss of kidney function: fluid overload, hyperkalemia, hypophosphatemia, metabolic acidosis, secondary hyperparathyroidism, anemia, and hypertension (1). The intention of the management of ESRD is to take into consideration patient requirements and make sure a positive outcome. According to data published by the Canadian Institute for Health Information, prevalent ESRD patients, with and without diabetes in Canada (excluding Quebec) in 2016 was 23419 (non-diabetics) and 14228 (diabetics) (2). An increasing number of patients with ESRD are being initiated on long-term dialysis every year in Canada (3). There are currently two treatment options for individuals who suffer from ESRD – Renal Replacement Therapy (RRT) or conservative management.

After renal transplant, dialysis (peritoneal dialysis and haemodialysis) is the most beneficial active management selections for individuals with ESRD (4). Korevaar et al. (5) performed a research study investigating the disparities in treatment consequence of peritoneal dialysis and haemodialysis and uncovered that there were no substantial differences, both methods demonstrating a two year quality adjusted life or five-year mortality. Peritoneal dialysis is a treatment, which patients can carry out by themselves at home. On the other hand, for haemodialysis patients need to visit a medical centre, in general three times a week. Mortality for patients on dialysis has been reported as 5% to 27% annually for patients in developed countries (1); in Canada, the

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mortality rate has been reported as 16.1 per 100 patient-years. Infection and cardiovascular disease are the two leading causes of death.

In order to provide haemodialysis in ESRD patients, a right and suitable type of access has to be created to establish a connection between haemodialysis cycle and circulatory system. Vascular access problems represent the main determinant of morbidity among haemodialysis patients and put a considerable degree of financial pressure on the healthcare sector (6,7). According to recently published research, there is considerable discrepancy in vascular access creation across Canada and not much agreement among Canadian practitioners relate to contraindications to arteriovenous fistula (AVF) construction (8). Canada has one of the lowermost frequency of AVF of any Dialysis Outcomes and Practice Patterns Study (DOPPS)-participating nation-state , and the percentage of patients utilising a central venous catheter in Canada continuously increasing (9,10). The main purpose of this study was to extract the distribution and trends of renal replacement therapy and vascular access type among end stage renal disease patients residing in Saskatchewan.

MATERIAL and METHODS

This study is a retrospective, registry-based population study included all patients who initiated renal replacement therapy in Saskatchewan from January 2006, to December 2016. We analyzed data received from the Canadian Organ Replacement Register- Canadian Institute for Health Information. The Canadian Organ Replacement Register (CORR) is a pan-Canadian information system managed by Canadian Institute for Health Information (CIHI). CORR collects data from hospital dialysis programs, transplant programs, organ procurement organizations (OPOs) and independent health facilities to track patients from their first treatment for end-stage organ failure (dialysis or transplantation) to their death.

Our primary objective was to calculate the prevalence of renal replacement therapy with organ transplant, peritoneal and hemodialysis in the province and to assess the trend of vascular access type in that province during 2006 to 2016. Patient demographics (age; gender, race, BMI, primary diagnosis and co-morbidities); causes of death, type of renal replacement therapy, type of dialysis access and blood markers ranges among haemodialysis and peritoneal dialysis patients from 2006 to 2016 in Saskatchewan were documented. Data was analyzed using Statistical Package for Social Sciences (SPSS) version 24. Data was expressed in frequencies, mean, median and percentages.

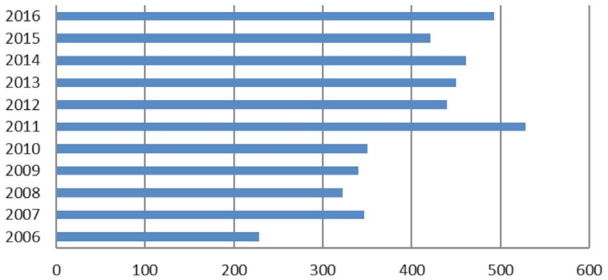
MATERIAL and METHODS

Demographic information of patients receiving renal replacement therapy is shown in Table 1. From 2006 through 2016, a total of 2103 patients with mean age of 69.52±13.2 initiated renal replacement therapy in Saskatchewan. Among these patients, over half of the patients were female (62%). Majority of the patients were Caucasians and Aboriginals. Nearly two third of the patients were overweight and obese. Less than half of the patient developed end stage renal diseases secondary to diabetes and 14.9% had a primary diagnosis of glomerulonephritis. Among all, hypertension was most prevalent among comorbid conditions. Other common comorbidities include ischaemic heart diseases, pulmonary edema, peripheral vascular disease and cerebrovascular accident.

Table 1. Demographics and Diagnosis: New Dialysis Patients from 2006 to 2016 in Saskatchewan

	Total	Percentages
Gender		
Male	801	38.1
Female	1300	61.8
Race		
Caucasian	1361	64.7
Aboriginal	580	27.6
Black	11	0.5
Asian	65	3.1
Other	7	0.3
Unknown	57	2.7
BMI		
Underweight	38	1.9
Normal	584	29.6
Overweight	655	33.2
Obese	695	35.2
Diagnosis		
CRF with unknown etiology	192	8.6
Glomerulonephritis	333	14.9
Hereditary renal diseases	125	5.6
Drug induced nephropathy	34	1.5
Polycystic kidney disease	3	0.1
Renal vascular disease	286	12.8
Diabetes	1018	45.5
Non-listed renal disorders	99	4.4
Other	146	6.5
Co-morbidities		
Angina	304	14.5
Myocardial infarction	357	17.1
Pulmonary edema	677	32.4
Diabetes type 1	12	0.6
Diabetes type 2	225	10.8
Cerebrovascular accident	310	14.8
Peripheral vascular disease	349	16.7
Malignancy	271	13
Lung disease	265	12.7
Hypertension	1824	87.3
Serious Illness	323	15.5
Current smoker	402	19.2
CABG	330	15.8

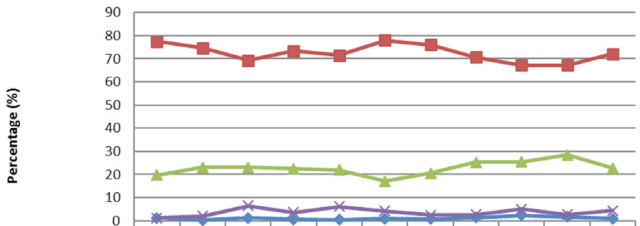
Canada (excluding Quebec) and prevalence of end-stage kidney disease patients was 1330 in the Saskatchewan. During 2006 to 2016, 72.3% received haemodialysis, 22.8% received peritoneal dialysis, 1.1% patients were on peritoneal dialysis combined with haemodialysis and 3.8% were living with a renal transplant in Saskatchewan province. There has been continuing progression in the number of patients receiving hemodialysis since it was first introduced (Figure 1).



	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Patients on RRT	228	347	322	340	350	528	440	450	461	421	493

Figure 1. Prevalence of Patients on renal replacement therapy, 2006 to 2016 (Rate per Million Populations)

In Saskatchewan, the proportion of patients receiving peritoneal dialysis decreased from 28.5% to 22.7% during 2015 and 2016. Figure 2 illustrates the type of renal replacement therapy used in Saskatchewan during the period 2006 to 2016. The number of patients receiving kidney transplants exhibited intermittently rises.

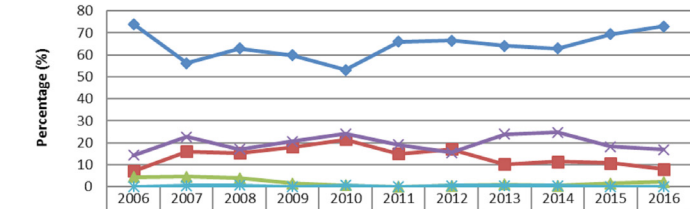


	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
PD combine with HD	1,3	0,3	1,2	0,6	0,5	0,9	0,8	1,4	2,3	1,7	0,9
Hemodialysis	77,5	74,6	69,3	73,4	71,4	77,9	76,1	70,7	67,2	67,2	72,1
Peritoneal Dialysis	19,8	23,1	23,1	22,4	21,9	17	20,6	25,3	25,5	28,5	22,7
Kidney Transplant	1,3	2	6,4	3,7	6,2	4,2	2,5	2,6	5	2,7	4,4

Figure 2. Type of Renal Replacement Therapy used from 2006 to 2016 in Saskatchewan

During 2006 to 2016 in Saskatchewan, catheter was the most frequently used dialysis access method (64.6%). Peritoneal dialysis access accounted for 19.7% and arteriovenous fistula 13.5% of the dialysis access (Figure 3). The percentage of use of arteriovenous graft was 1.9%. In the last ten years, the relative percentages of dialysis access have not experienced major transformation. This is illustrated in Figure 2, which indicates a constant higher prevalence of both permanent and temporary catheter as compared to arteriovenous fistula in the province of Saskatchewan.

A total of 2103 patients go dead for the duration of 2006 to 2016 who were receiving renal replacement therapy in the Saskatchewan. Study data showed known causes of death in patients on renal replacement therapy, were cardiac causes which were the most frequent and the second known cause of death was infection during 2006 to 2016. Other causes include drug related complications, vascular, gastrointestinal, respiratory and renal failure (Figure 4).



	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Catheter	74	56,2	62,9	59,8	53,2	65,9	66,5	64,1	62,9	69,4	72,9
AV Fistula	7,2	16	15,4	18,1	21,5	15	17	10,3	11,4	10,8	8
AV Graft	4,4	4,6	4	1,5	0,6	0	0,5	1,1	0,5	1,6	2,2
PD Access	14,4	22,7	17,1	20,6	24,1	19,1	15,6	23,9	24,8	18,3	16,9
Unknown	0	0,5	0,6	0	0,6	0	0,5	0,5	0,5	0	0

Figure 3. Type of Dialysis Access used from 2006 to 2016 in Saskatchewan

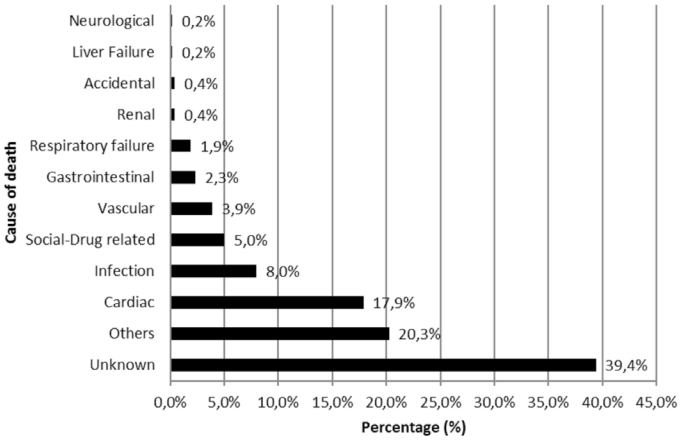


Figure 4. Cause of death among renal replacement therapy patients from 2006 to 2016 in Saskatchewan

During 2006 to 2016, the mean creatinine level of hemodialysis patients was 639.3 µmol/L and that of peritoneal dialysis patients was 704.9 µmol/L (Table 2). The mean serum HbA1c and albumin levels in hemodialysis patients were 6.8% and 32.8g/L, respectively. Although, theoretically, peritoneal dialysis patients have a lower prevalence of anemia than hemodialysis patients, during 2006 to 2016, the mean hemoglobin level was in the normal limit among hemodialysis patients (107.5g/L) and that of peritoneal dialysis patients was 110.9g/L. The mean total calcium and phosphorous levels in hemodialysis and peritoneal dialysis patients was same 2.2mmol/L. Mean serum parathyroid hormone level of hemodialysis patients was 55.2pmol/L and that of peritoneal dialysis patients was 42.2pmol/L.

The influence of the type of dialysis on survival of patients with ESRD is controversial. To see the permanent residential are among patients with end stage renal disease receiving peritoneal dialysis or hemodialysis, we assessed the first 2 digit of their postal code for area location from 2006 to 2016. During that period, 54.6% patients received

peritoneal dialysis therapy were residents of the central and east Saskatchewan area residents of Regina and Saskatoon each had about 17% each (Figure 5). In contrast, about 30% Saskatchewan haemodialysis patients were central and east Saskatchewan residents and about 24% and 29% of the patients in Regina Saskatoon residents received hemodialysis treatment, respectively.

Table 2. Blood Markers ranges among Haemodialysis and Peritoneal Dialysis patients from 2006 to 2016 in Saskatchewan

	Mean	Std. Dev	Medi-an	IQR	Mean	Std. Dev	Medi-an	IQR
Creatinine (µmol/L)	639.3	228.8	630.0	316.0	704.9	279.5	654.5	325.7
HbA1C (%)	6.8	1.5	6.5	1.9	6.6	1.5	6.3	1.7
Hemoglobin (g/L)	107.5	14.2	108.0	17.0	110.9	15.5	111.0	18.0
Ferritin (ng/mL)	687.0	529.2	587.0	589.5	514.6	433.4	392.0	480.2
Albumin (g/L)	32.8	5.1	33.0	5.0	30.9	4.8	31.0	6.0
Calcium (mmol/L)	2.2	0.2	2.2	0.26	2.2	0.2	2.3	0.2
Phosphate(mmol/L)	1.7	0.6	1.7	0.7	1.7	0.4	1.6	0.5
Parathormone (pmol/L)	55.2	73.9	37.9	44.6	42.2	36.8	33.5	31.1

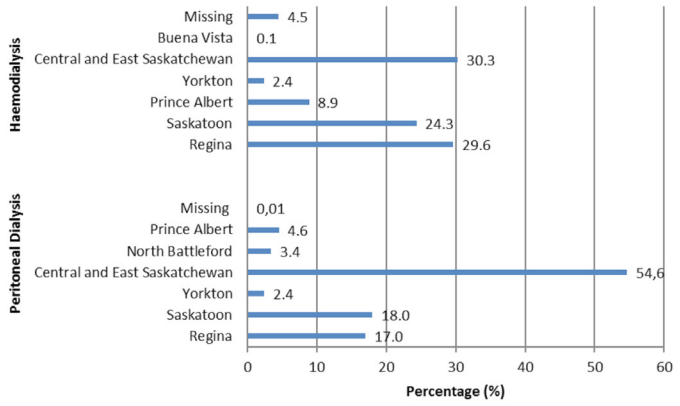


Figure 5. Provincial Dialysis Therapy during 2006 to 2016 in Saskatchewan

DISCUSSION

The focus of our study was patients with advanced renal failure receiving renal replacement therapy, with particular interest in results applicable to the Saskatchewan context. Chronic kidney disease characteristics are familiar to progressive disorder and can be perceived histologically as glomerulosclerosis, destruction of kidney cells and interstitial fibrosis. A total of 3 principal causes of renal failure have been recognized : a decrease in kidney blood flow, revealed in 40 to70% of cases by pre-renal causes [11, 12], impairment to the parenchymal renal tissue, brought about in 10-50% of cases by internal kidney predicaments , and blocked urine stream , determined in 10% of case by post-renal elements [13]. In this data we found less than half of the patient developed end stage renal diseases secondary to diabetes and 14.9% had a primary diagnosis of glomerulonephritis. According to Bakris [14] and Van Buren and Toto [15], the incidence rate of diabetic nephropathy has experienced a significant growth in recent years and it is currently the main determinant of ESRD on a global scale. In 40% of cases, it also has an influence on the development of CKD among adults suffering from type 2 diabetes.

In Saskatchewan nearly two third received haemodialysis, and less than one quarter received peritoneal dialysis in Saskatchewan. In the case that the patient chooses the first option, the Renal Association Clinical Practice Guidelines [4] suggest that all patients with stage five kidney disease, who are capable of tolerating such an immense surgical method and be able to acclimatize to long-standing immunosuppression, should receive a renal transplant. Preferably, if a suitable one exists; the kidney should be accepted from a living donor. Although, usually the waiting lists for living donor transplant are long, reaching 2858 in the Canada [2] and 7,235 in the United Kingdom, a number that escalates yearly by nearly 8% [5]. Actual number of patients needing a kidney transplant is assumed to be even higher, however most clinicians do not document all of them, as the possibility of getting a renal transplant is rather low. In Saskatchewan 115 and in Canada 3,351 patients were waiting for a kidney transplant, Canada, 2016 [2]. According to the United Kingdom Renal Registry report [6], kidney transplant was the most frequently used treatment method (48.6%) in 2010. Haemodialysis in clinical institutions had a similar percentage (43.8%). Home-based treatments, particularly peritoneal dialysis, accounted for 7.6% of the therapies.

In order to deliver haemodialysis in ESRD patients a suitable type of vascular access has to be constructed to initiate a connection between the dialysis cycle and circulation system of the patient. During 2006 to 2016 in Saskatchewan, catheter was the most frequently used dialysis access method. Peritoneal dialysis access accounted for 19.7% and arteriovenous fistula 13.5% of the dialysis access. The central venous catheters are the least selected modality and, in normal situation, no patient should have a catheter for vascular access. Even though the hazards accompanying with dialysis venous catheters, their utilization has grown to almost 70% of incident dialysis begin with venous catheters [16]. The longevity, durability, and favourable complication rate of the AVF have established it as the leading method of establishing permanent haemodialysis vascular access. Around two thirds of haemodialysis patients in the UK dialyse wes performed using an AVF [17]. Late presentation of patents with ESRD is one regularly experienced scenario that may have a substantial influence on vascular access creation.

In this situation, the phase in which renal replacement therapy is expected to commence may arrive before the patient can undergo vascular evaluation, surgical procedure, and successful development of their AV fistula.

Death rates in patients remedied with renal replacement treatment are considerably greater than in the general population [18]. Cardiovascular diseases have been identified as the leading cause of mortality in both dialysis and patients received renal transplant. Our analysis showed that most patients die from cardiovascular cause and non-cardiovascular reasons, through infections, drug related and vascular problems being the most frequent ones. A study conducted by Vogelzang et al. [19] showed that patients on dialysis were at an eighty two times increased risk of developing infection when compared with the normal people. Serious infections involved bacterial contaminations in 96% of the problems.

CONCLUSIONS

Worldwide increasing proportion of diabetic patients have resulted in a swift rise in the number of ESRD patients. Effective haemodialysis be determined by providing safe, effective, and long-lasting vascular access. Alarmingly, during 2006 to 2016 in Saskatchewan, catheter was the most frequently used dialysis access method. These outcomes should assist to facilitate and teach patients and health care professionals concerning the dangers accompanying with catheter usage among haemodialysis patients and highlight the demand for interventions that reduce catheter utilization within the entire ESRD population.

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Competing interests: The authors declare that they have no competing interest.

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Ethical approval: Not applicable as public de-identified (CIHI) data was analysed

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