Original Article

J Babol Univ Med Sci
Vol 18, Issu 3; Mar 2016. P:14-18

Comparison of Dialysis Adequacy in Permanent Catheter, Fistula, and Graft Vascular Access Types

M. Esmaeilivand (MSc)*[1], M.M. Mohammadi (BSc)[2], A. Khatony (PhD)[1], F. Najafi (PhD)[3]

1.Department of Nursing, Faculty of Nursing and Midwifery, Kermanshah University of Medical Sciences, Kermanshah, I.R. Iran

2.Student Research Committee, Faculty of Nursing and Midwifery, Kermanshah University of Medical Sciences, Kermanshah, I.R. Iran

3.Department of Epidemiology & Biostatistics, Faculty of Health, Kermanshah University of Medical Sciences, Kermanshah, I.R. Iran

J Babol Univ Med Sci; 18(3); Mar 2016; PP: 14-18

Received: Aug 25th 2015, Revised: Sep 28th 2015, Accepted: Jan 6th 2016.

ABSTRACT

BACKGROUND AND OBJECTIVE: Dialysis adequacy is one the leading causes of mortality in hemodialysis patients. On the other hand, type of vascular access is considered as one of the effective variables in dialysis adequacy. This study was performed to compare dialysis adequacy in three types of vascular access, namely permanent catheter, fistula, and graft.

METHODS: This sectional study was performed in 151 hemodialysis patients, who were chosen through convenience sampling and were allocated to permanent catheter (n=66), fistula (n=66), and graft (n=19) groups. The study was conducted in the Hemodialysis Ward of Imam Reza Hospital in Kermanshah, Iran. Dialysis adequacy was evaluated and compared in the three groups using urea reduction ratio (URR) and Kt/V criteria.

FINDINGS: Based on URR and Kt/V criteria, the mean of dialysis adequacy was 58.46±20.13 and 1.26±0.34, respectively, mean differences of URR and Kt/V criteria were not significant in the three groups.

CONCLUSION: Our findings demonstrated that there were no differences between permanent catheter, fistula, and graft types of vascular access in terms of dialysis adequacy; thus, any of these methods can be applied in its specific indication without being concerned about dialysis inadequacy.

KEY WORDS: *Dialysis adequacy*, *Permanent catheter*, *Fistula*, *Graft*.

Please cite this article as follows:

Esmaeilivand M, Mohammadi MM, Khatony A, Najafi F. Comparison of Dialysis Adequacy in Permanent Catheter, Fistula, and Graft Vascular Access Types. J Babol Univ Med Sci. 2015; 18(3):14-18.

***Corresponding author: M. Esmaeilivand (MSc)**

Address: Faculty of Nursing and Midwifery, Kermanshah University of Medical Sciences, Kermanshah, I.R.Iran

Tel: +98 83 38361129

E-mail: m_esmaeilivand@yahoo.com

[DOR: 20.1001.1.15614107.1394.18.3.2.6]

[DOI: 10.22088/jbums.18.3.14]

Introduction

The number of patients with end-stage renal disease (ESRD) is on a growing trend across the world (1, 2). The prevalence rate of this condition is 2000, 1500, and 800 cases per one million people in Japan, the USA, and Europe, respectively (3). To evaluate dialysis adequacy, urea reduction ratio (URR) and volume of dialyzer clearance of urea multiplied by time divided by the distribution volume of urea (Kt/V) are applied.

The minimally adequate doses of URR and Kt/V are 65% and more than ½, respectively. According to the United States Renal Data System, for each 0.1% increase in Kt/V up to 1/2, mortality rate reduces by 0.7% and for each 5% increase in the URR up to 65%, mortality rate decreases by 11% (4, 5). Some studies investigating dialysis adequacy indicated low dialysis adequacy in Iran (6, 7).

In fact, inadequacy in dialysis can lead to disability and mortality in patients. Dialysis adequacy might be influenced by some modifiable factors such as vascular access (8). There is a scarcity of studies comparing dialysis adequacy based on vascular access type, and the few performed studies have some limitations such as small sample size and application of only one type of vascular access.

One of the most fundamental problems in dialysis patients is low dialysis adequacy, and type of vascular access can play an important role in this matter. Therefore, in the present study, we aimed to compare vascular access types of permanent catheter, fistula, and graft in terms of dialysis adequacy and to determine the most efficient types of vascular access in dialysis patients.

Methods

In this cross-sectional study, 151 patients, referring to Imam Reza Hospital of Kermanshah, Iran, were randomly recruited through convenience sampling and were divided into three groups based on type of vascular access (i.e., permanent catheter, arteriovenous fistula, and arteriovenous graft).

The inclusion criteria were undergoing dialysis more than three times a week, being aged more than 20 years, undergoing hemodialysis for at least six months, and weighing 60-80 kg. Given the differences between permanent catheter and fistula groups, with the mean dialysis adequacy of 4.94 and standard deviation of 7, 33 patients should be allocated to each group. However, due to the limited number of patients in the graft group (n=19), the number of patients in the other two groups was doubled (n=66 in the two other groups).

Overall, 151 patients participated in this study (statistical power: 80%). Considering the fact that some factors including age, gender, weight, blood pump speed, filter size, and dialysis duration can affect the quality of dialysis, in this study all the three groups were matched according to age, gender, weight, and filter type. Moreover, duration of hemodialysis was four hours for all the groups.

For the purpose of sampling, the second dialysis session of week was chosen to identify the increase in weight between the two dialysis sessions. Dialysis was performed using the same dialyzer for all the patients. To confirm the reliability of the dialyzer, it was calibrated before each dialysis, and the same adjustment was applied for all the patients. Blood samples were drawn from arterial line without dilution by heparin or normal saline before starting dialysis. To collect blood samples after dialysis, the pump speed was lowered to 50-100 cc/min for about 10-20 seconds and it was stopped, and then blood sampling was performed.

For ethical considerations, sampling was started after explaining the aim of the study to the patients, assuring the patients of the confidentiality of the personal information, and obtaining informed consent from the patients. Chi-square and Pearson's correlation coefficient tests were run, using SPSS version 17. $P<0.05$ was considered statistically significant.

Results

Out of the 151 hemodialysis patients, 81 were female (53.3%) and 71 were male (46.7%). The mean age of the participants was 55.77±12.14 years and mean history of dialysis in these patients was 38±35 months. With respect to vascular access type, 49.3% of the patients underwent fistula dialysis, 25.7% graft, and the remaining 25% had permanent catheter. The mean age was 54.58±13.84 years in the fistula group, 57.74±14.77 years in the graft group, and 59.15±13.84 years in the permanent catheter group. There were no significant differences between the groups in terms of demographic variables (table 1). Mean dialysis adequacy was reported 58.46±20.13 based on the URR criterion and 1.26±0.34 based on Kt/V criterion. Comparison of the mean URR criterion in the fistula,

[DOR: 20.1001.1.15614107.1394.18.3.2.6]
[DOI: 10.22088/jbums.18.3.14]

graft, and permanent catheter groups revealed that this value was higher in the graft group (60±20.73). In these three groups, mean of Kt/V criterion was greater in the fistula group than the other two groups (1.28±0.37) but this difference was not statistically significant (table 2). Dialysis adequacy of URR criterion was 60.28±16.66 for males and 56.87+22.72 for females, which was not statistically significant. The Kt/V criterion represented no statistical differences between males and females (table 3). There was a significant statistical relationship between the height of hemodialysis patients and dialysis adequacy (p=0.004).

Table 1. Frequency distribution and percentiles of the demographic variables of the fistula, permanent catheter, and graft groups

Variables		Permanent catheter N(%)	Fistula N(%)	Graft N(%)	P-value	All patients N(%)
Gender	Male	16(42.1)	40(53.3)	15(38.5)	0.258	71(46.7)
	Female	22(57.9)	35(46.7)	24(61.5)		81(53.3)
Underlying disease	Diabetes	3(7.9)	6(8)	0(0)	0.293	9(5.9)
	Hypertension	22(57.9)	37(49.3)	20(51.3)		79(52)
	Hepatitis B	0(0)	4(5.3)	0(0)		4(2.6)
	Hepatitis C	1(2.6)	9(12)	3(7.7)		13(8.6)
	Vesicoureteral reflux	0(0)	2(2.7)	2(5.1)		4(2.6)
	Nephrolithiasis	2(5.3)	0(0)	2(5.1)		4(2.6)
	Nephrotic syndrome	1(2.6)	1(1.3)	1(2.6)		3(2)
	Wagner's syndrome	1(2.6)	0(0)	1(2.6)		2(1.3)
Education	Illiterate	22(57.9)	29(38.7)	15(38.5)	0.575	66(43.4)
	Primary to high school	9(23.7)	30(40)	16(41)		55(36.2)
	High school graduate	6(15.8)	14(18.7)	7(17.9)		27(17.8)
	University students	1(2.6)	2(2.7)	1(2.6)		4(2.6)
Place of residence	City	34(89.5)	70(93.3)	35(97.4)	0.38	142(93.4)
	Village	3(7.9)	5(6.7)	1(2.6)		9(5.9)
Kidney transplantation	Yes	3(7.9)	9(12)	5(12.8)	0.752	17(11.2)
	No	35(92.1)	66(88)	34(87.2)		135(88.8)

Table 2. Comparison of URR and Kt/V criteria in the fistula, graft, and permanent catheter groups

Variable	Permanent catheter	Fistula	Graft	P-value	All the patients
Urea reduction ratio	58.09±20.37	57.58±19.91	60±20.73	0.858	58.46±20.13
Kt/V	1.27±0.26	1.28±0.37	1.21±0.33	0.602	1.26±0.34

Table 3. Correlation between demographic variables and Kt/V and URR criteria

Variable	Urea reduction ratio		Kt/V	
	P-value	r	P-value	r
Body mass index	0.99	-0.001	0.487	-0.05
Age (years)	0.716	-0.03	0.313	0.08
Height (cm)	0.761	-0.02	0.004	-0.23
History of dialysis (month)	0.298	-0.08	0.363	0.07

p<0.05 was considered significant

[DOR: 20.1001.1.15614107.1394.18.3.2.6]
[DOI: 10.22088/jbums.18.3.14]

Discussion

In the current study, there were no significant differences between the types of vascular access in terms of dialysis adequacy (9). Likewise, in a study by Mutevelic et al. in which Kt/V was considered as the criterion for evaluation of adequacy, no significant differences were observed between the fistula and catheter groups regarding dialysis adequacy.

Although the differences were not significant, dialysis adequacy based on Kt/V criterion for the fistula group was higher than the permanent catheter and graft groups. Dialysis adequacy based on the URR criterion was higher for the graft group. Graft and fistula types of vascular access were more efficient based on the URR and Kt/V criteria. In this regard, Canaaud et.al reported that dialysis adequacy for the patients with arteriovenous (AV) fistula and graft was higher, compared to patients with permanent catheter (10). In a similar study, Kukavica et.al revealed that patients with fistula had higher Kt/V value compared to those with permanent or temporary catheter (8). In the present study, although no significant differences were found between the three access types, fistula and grafts approaches were more efficient.

Compared to the studies by Kukavica and Canaaud (8, 10), the current study, using the Kt/V, URR criteria and a larger sample size (151 patients), demonstrated that there were no significant differences between the three types of vascular access regarding dialysis adequacy. This study can alleviate concerns over dialysis adequacy in different types of vascular access; thus, any of the vascular access types of permanent catheter, fistula and graft can be applied in their specific indications.

In this study, dialysis adequacy was lower than the desirable level. Some former studies conducted in Iran indicated low dialysis adequacy, as well. In this regard, Tayyebi et.al in their study performed in Tehran reported that the mean Kt/V over ½ was 50.5% and that 46% of their patients had URR over 65% (7). Given the relationship between dialysis adequacy, disease complications, and rate of mortality, the necessary measures should be taken to promote dialysis adequacy (11).

In the present study, in accordance with the study by Teixeira Nunes et.al, an indirect significant correlation was found between height and Kt/V, that is, the higher the height of patients, the the lower Kt/V value would be (12). In addition, in contrary to the results of Teixeira Nunes et.al, no significant difference was observed between males and females regarding dialysis adequacy. To justify the greater value of Kt/V in females compared to males, Teixeira Nunes et.al. proposed that since females are genetically shorter than males, Kt/V value was greater in females compared to males. In this study however, no significant differences were noted between males and females regarding dialysis adequacy and there seem to be some confounding variables affecting our results (12).

In general, we did not find any significant differences between permanent catheter, graft, and fistula types of vascular access and they can be applied in their specific indication without causing any concerns in patients and hospital staff. Nevertheless, performing further studies on this issue is recommended.

Furthermore, by emphasizing on one study no definitive conclusion can be drawn about the superiority of one type of vascular approach over the others; therefore, conducting a more comprehensive study using a larger sample size is suggested for future studies.

Acknowledgments

We would like to thank the Research Committee of Kermanshah University of Medical Sciences for their financial support and all the patients and hospital staff who cooperated with this study.

[DOR: 20.1001.1.15614107.1394.18.3.2.6]
[DOI: 10.22088/jbums.18.3.14]

References

1.Eggers PW. Has the incidence of end-stage renal disease in the USA and other countries stabilized?.Curr Opin Nephrol Hypertens. 2011;20(3):241-5.

2.Firoozjahi A, Akbari R, Heidari B, Setvati J, Ghazimirsaeed A, Hajian K, et al. Evaluation of serum omentin concentration and its association with cCardiovascular risk factors in patients undergoing hemodialysis. J Babol Univ Med Sci. 2015;17(11):28-34.[In Persian]

3.Barsoum RS. Chronic kidney disease in the developing world. N Engl J Med. 2006 Mar 9;354(10):997-9.

4.Waniewski J, Lindholm B. Fractional solute removal and KT/V in different modalities of renal replacement therapy. Blood Purif. 2004;22(4):367-76.

5.Debowska M, Waniewski J, Lindholm B. Dialysis adequacy indices for peritoneal dialysis and hemodialysis. Adv Perit Dial. 2005;21:94-7.

6.Roozitalab M, Moohamadi B, Najafi S, Mehrabi S. Determining the Adequacy of Hemodialysis in Hemodialysis Units of Kohgilouyeh and Boyerahmad Hospitals in 2009. (Armaghan Danesh) J Yasuj Univ Med Sci.2010;15(3):273-82. [In Persian]

7.Tayyebi A, Shasti S, Ebadi A, Eynollahi B, Tadrisi SD. The relationship between blood pressure and dialysis adequacy in dialysis patients. J Critical Care Nur. 2012;5(1):49-54. [In Persian]

8.Kukavica N, Resic H, Sahovic V. Comparison of complications and dialysis adequacy between temporary and permanent tunnelled catheter for haemodialysis. Bosn J Basic Med Sci. 2009;9(4):265-70.

9.Mutevelic A, Spanja I, Sultic-Lavic I, Koric A. The impact of vascular access on the adequacy of dialysis and the outcome of the dialysis treatment: one center experience. Materia Sociomedica. 2015;27(2):114-7.

10.Canaud B, Leray-Moragues H, Kerkeni N, Bosc JY, Martin K. Effective flow performances and dialysis doses delivered with permanent catheters: a 24-month comparative study of permanent catheters versus arterio-venous vascular accesses. Nephrol Dial Transplant. 2002;17(7):1286-92.

11.Daugirdas JT, Tattersall J. Effect of treatment spacing and frequency on three measures of equivalent clearance, including standard Kt/V. Nephrol Dial Transplant. 2010;25(2):558-61.

12.Teixeira Nunes F, de Campos G, Xavier de Paula SM, Merhi VA, Portero-McLellan KC, da Motta DG, et al. Dialysis adequacy and nutritional status of hemodialysis patients. Hemodial Int. 2008;12(1):45-51.

[DOR: 20.1001.1.15614107.1394.18.3.2.6]

[DOI: 10.22088/jbums.18.3.14]