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KT/V is Not a Good Predictor of Hemodialysis Performance on DM-ESRD Patients

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Abstract: ***Introduction: Diabetes mellitus (DM) is the most frequent cause of ESRD (20-40%). Depression, sexual dysfunction, neuropathy, and poor quality of life are some of the common consequences of DM-ESRD. Worsening the condition, some patients become un-adhere to the therapeutic regimen. Kt/v was used to assess hemodialysis adequacy without paying attention to other success parameter (depression, sexual dysfunction, neuropathy, and quality of life). This study was aimed to reveal the relationship between kt/v and those parameters. Methods: This is an analytic descriptive research conducted in BHCC, Bali. The participants of this study were 42 ESRD (routine-hemodialysis) with DM patients. SF-36, PHQ-9, FSFI, SHIM, DN4 questionnaire, and kt/v measurement were used to gather the data. Results: There were 56.10% female and 43,90% male included in this study whose age were 40-60 y.o. (85,37%) and >60 y.o. (14,63%). Among them, 70,73% has been routinely hemodialyzed ≥1 year and 80,49% has DM history of ≥5 years. There were 95, 12% subjects whose kt/v was <1,8. It was noted that 78% of the patients having kt/v of ≥1.8 had neuropathic pain, while it was only 75% patient on those with kt/v < 1,8. There was insignificant-very weak correlation (p≥0,05; r<+/-0,2) between kt/v and depression, quality of life, and female sexual disfunction. Only Erectile dysfunction has significant-moderate correlation (p=0,045; r=0,423) with kt/v. Conclusion: Kt/v is just a number that does not correlated strongly with ESRD related complications including depression, sexual dysfunction, neuropathy, and quality of life in hemodialyzed DM-ESRD patients..***

Keywords: Hemodialysis, diabetes mellitus, depression, sexual dysfunction, kt/v

1. Introduction

Diabetes mellitus (DM) is the most common cause of ESRD (End Stage Renal Disease). Accounting for 20%-40% of the ESRD cases was caused by diabetes mellitus.[1]Patients who underwent ESRD with DM needs some routine and life-long treatments which require patient's compliance. The better the patient's compliance, the better the therapeutic results.[2]Depression, sexual dysfunction, neuropathy, and poor quality of life are some of the common consequences of DM-ESRD. Worsening the condition, some patients become un-adhere to the therapeutic regimen.[3]

In this study, we recorded the kt/v of the patientsand used some tools to assess patient's depression, sexual dysfunction, neuropathy, and quality of life. Those tools were PHQ-9 (assess the degree of depression), SHIM (assess male erectile dysfunction), FSFI (assess female sexual dysfunction), and DN4 (knowing the presence of neuropathy). Finally, we analyses the relation between kt/v and other variables. Knowing the detail of those variables would give an overview of our patient's condition in BHCC clinic.

2. Methods

This is an analytic descriptive research research conducted in BHCC, Bali. The participants of this study were 42 ESRD (routine-hemodialysis) with DM patients. SF-36, PHQ-9, FSFI, SHIM, DN4 questionnaire, and kt/v measurement were used to gather the data. We were also dividing patient by age (40-60 y.o and >60 y.o), sex, duration of DM (<5 year and ≥5 year), duration of HD (<1 year and ≥1 year), and what the patients take to control their blood glucose (no medication, oral medication, and insulin).

SF (Short Form)-36
SF-36 is a questionnaire to assess patient's quality of life. This questionnaire contain 36 question and includes eight multiple-item subscales that evaluated physical function, social functioning, role limitations due to physical problems, role limitations due to emotional problems, mental health, vitality, pain, and general health perception. Each subscale ranges between 0 and 100. The greater score, the better quality of life.4We counted the average of each score and categorized them as below and above average.

PHQ (Patient Health Questionnaire)-9
PHQ-9 is a questionnaire to assess the degree of depression. There are 9 question with each value between 0-5. The score were summed up and categorized according to PHQ-9 interpretation. Those category are minimal/none depression (0-4), mild depression, moderate depression (5-9), moderate-severe depression (15-19), and severe depression (20-27).[5]

FSFI (Female Sexual Function Index)
FSFI was commonly used for the diagnosis of female sexual dysfunction. This questionnaire contains 19 questions with multiple-choice responses that assess sexual function in the last four weeks, associated with six domains and possible types of disorders: desire, arousal, lubrication, orgasm, satisfaction with sexual life, and pain during or after intercourse. Each question influences its specific domain. A score of 0 means there are no sexual activity, others are numbered between 1 and 5. The overall score of each domain were totalled in order to assess sexual dysfunction.[6]

SHIM (Sexual Health Inventory for Men)

The SHIM contains five specific questions about sexual functioning over the previous 6 months. There are five questions each value between 0 and 5 summed with a possible score range from 1 to 25. Patients who score 21 or less may be at high risk of ED. Grades of ED severity using SHIM scores are : normal (no ED), score 22–25; mild ED, 17–21; mild-to- moderate, 12–16; moderate, 8–11 and severe, 1–7.[7]

DN4

The DN4 questionnaire is a clinician administered screening tool consisting of 10 items divided in 4 categories. The first category includes 3 items that related to pain characteristic. The second contain of 4 items that related to symptoms (tingling, pins and needles, numbness, and itching). The third category include 2 items related to sign on physical examination. The last category has only 1 item regarding allodynia. "Yes" answer has a value of 1. Neuropathy is established when total score $\geq$ 4.[8]

3. Results

There were 56, 10% female and 43,90% male included in this study whose age were 40-60 years old (85,37%) and >60 years old (14,63%). Among them, 70,73% has been routinely hemodialysed ≥1 year and 80,49% has DM history of ≥5 years. 39,02% of them did not take OAD and insulin anymore since underwent HD, 12,20% still using OAD, 39,02% used insulin, and 9,78% used both OAD and insulin. There were 95, 12% subjects whose kt/v was <1,8.

Table 1: General profile

Attribute (s)	Category	Proportion (%)
Age	40-60 y.o.	85.37
	>60 y.o.	14.63
Sex	Male	43.9
	Female	56.1

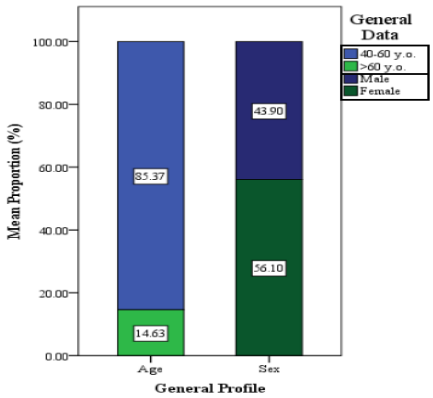

Figure 1: General profile

Table 2: Patient's proportion based on neuropathic pain, kt/v, hemodialysis duration, diabetes mellitus duration, diabetes mellitus pharmacotherapy, depressive state (PHQ-9), and erectile disfunction (SHIM)

Attribute(s)	Category	Proportion (%)
Neuropathic Pain	Absent	24.39
	Present	75.61
kt/v	< 1.8	95.12
	≥ 1.8	4.88
Hemodialysis duration	<1 year	29.27
	≥1 year	70.73
DM duration	<5 year	19.51
	≥5 year	80.49
DM Pharmacotherapy	No therapy	39.02
	Oral Anti-DM	12.2
	Oral Anti-DM + Insulin	9.778
	Insulin	39.02
Depressive State (PHQ-9)	Minimal	34.15
	Mild	26.83
	Moderate	17.07
	Moderate-Severe	14.63
	Severe	7.32
Erectile Dysfunction	No Dysfunction	17.86
	Mild	3.57
	Mild-Moderate	7.14
	Moderate	21.43
	Severe	50

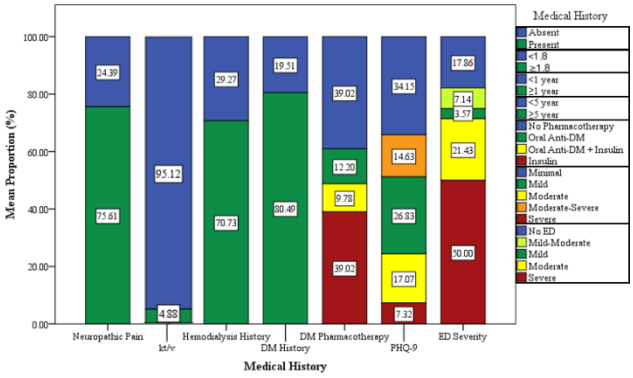

Figure 2: Patient's proportion based on neuropathic pain, kt/v, hemodialysis duration, diabetes mellitus duration, diabetes mellitus pharmacotherapy, depressive state (PHQ-9), and erectile disfunction (SHIM).

Using DN4 questionnaires, it was noted that the respondent's proportion of neuropathic pain was 75,61%. It was noted that 78% of the patients having kt/v of ≥1.8 had neuropathic pain, while it was only 75% patient on those with kt/v < 1,8.

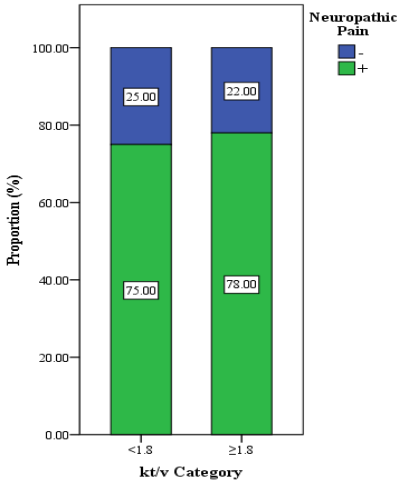

Figure 3: Neuropathy occurrence in patient with kt/v < 1,8 and kt/v $\geq$ 1,8

Based on the PHQ-9 questionnaire, 65,9% of patients experienced depression (other than minimal stage) with some specific stages. Those stage were mild depression (26,

83%), moderate depression (17,07%), moderate-severe depression (14,63%), and severe depression (7,32%).There was an insignificant-very weak correlation with kt/v (p≥0,05; r<+/-0,2).

Sexual dysfunction for male was assessed by SHIMresulted 82,14% of male patients had erectile dysfunction: mild ED (3,57%), mild-moderate ED (7,14%), moderate ED (21,43%), and severe ED (50%). There was a significant positive moderate correlation between kt/v and erectile disfunction (p=0,045; r=0,423). Using FSFI, we found that female sexual dysfunction were 77, 78%. FSFI showed that 77, 78% of them had the same percentage in sexual arousal dysfunction, desire dysfunction, lubrication problem, difficulty orgasm, pain, and sexual satisfaction problem.The correlation female sexual disfunction was insignificant-very weak (p≥0,05; r<+/-0,2).

Table 3: Proportion of female sexual disfunction based on FSFI questionnaire

Attribute(s)	Non-Dysfunctional (%)	Dysfunctional (%)
Arousal	22.22	77.78
Desire	27.78	72.22
Lubrication	22.22	77.78
Orgasm	22.22	77.78
Pain	33.33	66.67
Satisfaction	22.22	77.78

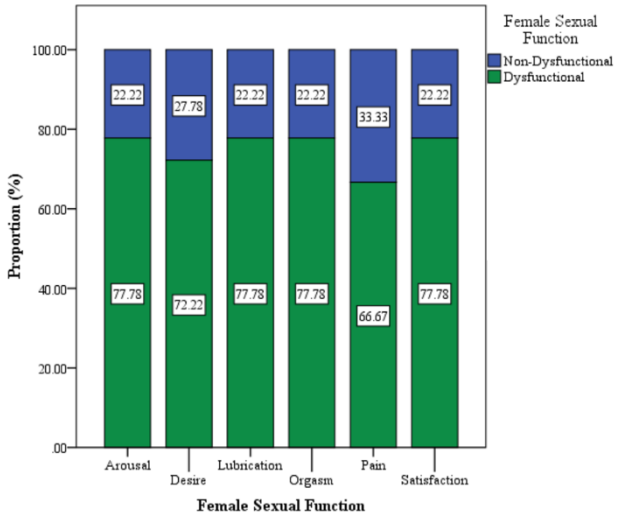

Figure 3: Proportion of female sexual disfunction based on FSFI questionnaire

SF-36 questionnaire showed that "Role limitation due to physical" (53,66%), "Role limitation due to emotion" (53,66%) and "Pain Scale" (60,98%) were the most prominent factors in reducing well-being of the participants (below average). Other items like "Physical function", "Energy/Fatigue", "Social", and "General health" were above average. All SF-36 components had insignificant-very weak correlation with kt/v (p≥0, 05; r<+/-0, 2).

Table 4: Percentage of patient's quality of life based on SF-36 questionnaire

Attribute(s)	Above Average (%)	Below Average (%)
Physical Function	60.98	39.02
RLDP	46.34	53.66
RLDE	46.34	53.66
Energy/Fatigue	53.66	46.34
Emotional Wellbeing	56.1	43.9
Social Capacity	65.85	34.15
Pain Scale	39.02	60.98
General Health	56.1	43.9
Health Change	82.93	17.07

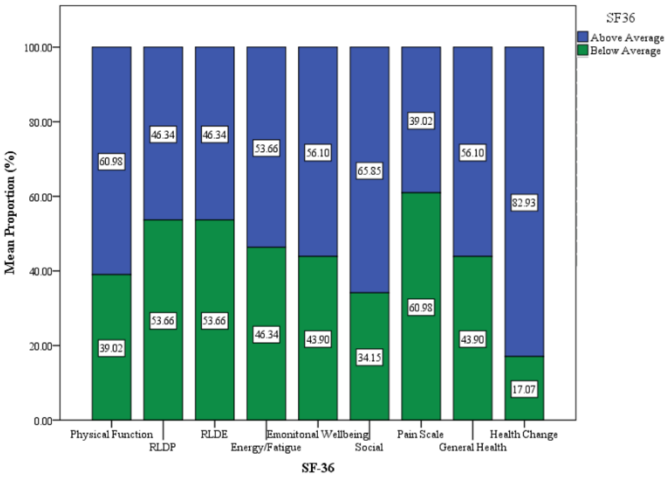

Figure 4: Percentage of patient's quality of life based on SF-36 questionnaire

Table 5: Positive correlation analysis between kt/v, patient's quality of life, and male erectile disfunction

Independent Variable	Dependent Variable	P-value/R-value	Interpretation
Kt/v (all gender)	Physical Function	0.251/ 0.184	Not-significant/ very weak cor.
	RLDP	0.473/ 0.115	Not-significant/ very weak cor.
	E/F	0.343/ 0.152	Not-significant/ very weak cor.
	EWB	0.356/ 0.148	Not-significant/ very weak cor.
	Social	0.557/ 0.094	Not-significant/ very weak cor.
	GH	0.596/ 0.085	Not-significant/ very weak cor.
	HC	0.519/ 0.104	Not-significant/ very weak cor.
Kt/v (male only)	Erectile Dysfunction	0.045/ 0.423	Significant/ moderate cor.

Table 6: Negative correlation analysis between kt/v, patient's quality of life, and female erectile disfunction.

Independent Variable	Dependent Variable	P-value/ R-value	Interpretation
Kt/v (All gender)	PHQ-9	0.408/-0.133	Not-significant/ very weak cor.
	RLDE	0.304/-0.164	Not-significant/ very weak cor.
	Pain	0.972/-0.006	Not-significant/ very weak cor.
Kt/v (female only)	Sexual Dysfunction	0.096/-0.404	Not-significant/ moderate cor.

4. Discussion

The patient's proportion of hemodialysis duration more than 1 year was 70.73% and diabetes mellitus duration more than 5 years was 80,49%. Neuropathic pain was occurred in

75,61% patient. From those results we can figure that the longer duration of hemadialysis and diabetes mellitus, the more frequent the complications occur. In this case, the complication was neuropathic pain. Other study also claimed that neuropathy occurred 5 years since diabetes mellitus was first diagnosed.[9]

Other studies have indicated that the kidney is responsible for up to 20% of all glucose production via gluconeogenesis. In normal condition, up to 180 g/day of glucose is filtered by renal glomerulus and reabsorbed in the proximal convoluted tubule.[10] Those function could be disturbed if the patient fall into ESRD with DM. This condition lead them to a normal glucose level.There was 39,02% of patients who did not take any medicine and insulin for controlling their blood glucose anymore since they got ESRD and had to underwent hemodialysis. Therefore, we have to re-evaluate the use of OAD and insulin in order to prevent hypoglycemia condition.

The most common method for measuring HD adequacy, based upon urea clearance, is kt/v. Previous study recommend a minimum kt/v dose of 1,2 for patients who receive hemodialysis 3 times a week and ≥ 1,8 if receiving twice weekly hemodialysis.[11-15] Based on the result, we found that there were 95,12% patients whose kt/v below 1,8.In line to that result, there were 65,85% patients had depression, 82,14% male patients had erectile dysfunction, and around 70% female patients had sexual disfunction, whether arousal, desire, lubrication, orgasm, pain, and satisfaction disorder. In terms of number it showed a positive relation, but no the correlation. Kt/v and those parameters had an insignificant-very weak correlation with kt/v ($p \geq 0$, 05; $r < +/-0,2$), except kt/v with male erectile disfunction which had significant-moderate correlation ($p=0,045$; $r=0,423$).

Quality of life also showed a positive relation to kt/v. Based on SF-36, role limitation due to physical, role limitation due to emotion, and pain scale were the most prominent factors in reducing well-being of the participants.But it showed the sameinsignificant-very weak correlation with kt/v($p \geq 0,05$; $r < +/-0,2$).

We can conclude that kt/v isnot related to other parameters. It is important to give holistictreatment to the patient individually and pay attention to their depression, sexual function, and quality of life to achieved hemodialysis target.

5. Conclusion

Patient with ESRD and DM need regular and long-term medication. Appropriate therapy and patient's compliance play important role in this long-term medication. A holistic examination have to be done in routine hemodialysis patient with DM in order to improve patient's compliance and achieved therapeutic targets.

Kt/v is just a number that does not correlated strongly with ESRD related complications.We re-emphasize that therapeutic targets are not kt/v, but depression, sexual disfunction, quality of life, and complications simultaneously.

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