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EFFECT OF DIALYZER REUSE UPON UREA REDUCTION RATIO (URR), KT/V UREA AND SERUM ALBUMIN IN REGULAR HEMODIALYSIS PATIENT

Ni Made Amelia R. Dewi, Budi Suprapti, I Gde Raka Widiana

Abstract

Reuse of dialyzers for hemodialysis can help in bringing down the cost of hemodialysis. On the other hand reuse of dialyzer may change dialyzer integrity. This study was undertaken to determine dialyzer reuse effect on Urea Reduction Ratio (URR), Kt/V urea and serum albumin. This was prospective study in Sanglah Public General Hospital Denpasar. Inclusion criteria for this study were patients who receive hemodialysis more than 3 months on twice weekly hemodialysis. In the study we used hollow fiber or dialyzer Elisio type H-130H reprocessed with Renaline automatically by machine renatron. After each session blood urea, post dialysis weight and serum albumin were measured. Measurements was performed on the use new dialyzer, 1st reuse, 4th reuse and 7th reuse. The dialyzer was discarded, if TCV fell below 80% of baseline value. Kt/V and urea reduction ratio (URR) were calculated as measure of dialysis adequacy. A total of 23 people completed the study. There was a lack of uniformity duration of hemodialysis, so that we also performed an analysis using a uniform length hemodialysis duration (4.5 hours) with 15 samples. There were no significant difference between URR and Kt/V urea of new dialyzer and dialyzer reprocessed by renaline respectfully with $p=0.131$ and $p=0.373$. If we analyzed only using uniform time of dialysis (4.5 h) the value of URR and Kt/V urea between new and reused dialyzer not significantly different with $p=0.520$ and $p=0.784$. There was also not found significant differences between serum albumin of the use new dialyzer and reused dialyzer by the time of uniform or non-uniform, respectfully with $p=0.271$ and 0.073. Reuse dialyzer does not alter efficacy of hemodialysis.

Key words : Dialyzer, Urea Reduction Ratio (URR), Kt/V Urea, Albumin, Total Cell Volume (TCV)

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Research Article

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ABSTRACT

Reuse of dialyzers for hemodialysis can help in bringing down the cost of hemodialysis. On the other hand reuse of dialyzer may change dialyzer integrity. This study was undertaken to determine dialyzer reuse effect on Urea Reduction Ratio (URR), Kt/V urea and serum albumin. This was prospective study in Sanglah Public General Hospital Denpasar. Inclusion criteria for this study were patients who receive hemodialysis more than 3 months on twice weekly hemodialysis. In the study we used hollow fiber or dialyzer Elisio type H-130H reprocessed with Renaline automatically by machine renatron. After each session blood urea, post dialysis weight and serum albumin were measured. Measurements was performed on the use new dialyzer, 1st reuse, 4th reuse and 7th reuse. The dialyzer was discarded, if TCV fell below 80% of baseline value. Kt/V and urea reduction ratio (URR) were calculated as measure of dialysis adequacy. A total of 23 people completed the study. There was a lack of uniformity duration of hemodialysis, so that we also performed an analysis using a uniform length hemodialysis duration (4.5 hours) with 15 samples. There were no significant difference between URR and Kt/V urea of new dialyzer and dialyzer reprocessed by renaline respectfully with p=0.131 and p=0.373. If we analyzed only using uniform time of dialysis (4.5 h) the value of URR and Kt/V urea between new and reused dialyzer not significantly different with p=0.520 and p=0.784. There was also not found significant differences between serum albumin of the use new dialyzer and reused dialyzer by the time of uniform or non-uniform, respectfully with p=0.271 and 0.073. Reuse dialyzer does not alter efficacy of hemodialysis.

Key words : Dialyzer, Urea Reduction Ratio (URR), Kt/V Urea, Albumin, Total Cell Volume (TCV)

INTRODUCTION

Hemodialysis in Indonesia started since 1970 and has been carried out until now. Hemodialysis is one of the medical interventions that need a lot of costs. Reuse of dialyzers for hemodialysis can help in bringing down the cost of hemodialysis (Prihanto, 2001). Reuse of the dialyzer may affect its performance as a result of deposition of blood elements inside the lumen of the blood compartment and on to the dialyzer membrane. Reprocessing procedure may also damage the membrane thus affecting the performance (Cheung et al., 1999).

Prihanto (2001) was using dialyzer nipro FB 100T reprocessed with formaldehyde and

H2O2 found significant decrease of URR and Kt/V urea on the 4th reuse of dialyzer. Meanwhile Aggarwal, et al (2012) was using F6 dialyzer polysulfane processed using formaldehyde, reused for 3 times and found no significant difference in the value of URR and Kt/V urea in to 3 groups of reuse (Aggarwal, et al., 2012).

Reuse and reprocessing dialyzer repeatedly may influenced hemodialysis due to the occurrence of binding molecule albumin on dialyzer membrane and even in certain circumstances albumin may leak during hem dialysis (Riyanti, 2001).

The use of bleaching or heated citric acid during reprocessing found to have a beneficial

effect on the clearance of solute molecules are like beta-microglobulin, but decreased albumin levels were significantly on dialiser polysulfone (F80) if the processing is repeated with bleaching (Kaplan *et al.*, 1995). This study was undertaken to determine dialyzer reuse effect on Urea Reduction Ratio (URR), Kt/V urea and serum albumin.

MATERIAL AND METHODS

This was a Prospective observational study using the Analytical measurement of BUN and serum albumin pre and post hemodialysis in Sanglah Public Hospital Denpasar. Measurements made on the use of new dialyzer, 1st, 4th and 7th reuse first. Inclusion criteria for this study were patients who receive hemodialysis more than 3 months (chronic Hemodialysis) with frequency twice a week. Patients with unstable conditions: sepsis, shock, positive HBsAg (secondary data) and HIV-positive are not included in the study. We used bicarbonate as a buffering agent and Elisio type H-130H dialyzer reprocessed using Renalin automatically by machine renatron in this study. Blood flow ranged from 200-300mL/min and dialysate flow rate was fixed at 500mL/min. Dialyzers were discarded if the TCV fell to < 80% of its initial value.

URR was calculated using following formula

$$URR = \frac{(U_{pre} - U_{post})}{U_{pre}} \times 100$$

Where, U_{pre} and U_{post} are predialysis and postdialysis urea level respectively.

Kt/V was calculated by using Daugirdas 2nd generation formula

$$'Kt/V' = \frac{-\ln[R - 0.03] + [4 - 3.5R] \times UF}{w}$$

Where, R=Post BUN/Pre BUN; UF = Achieved ultrafiltration; w = Post dialysis weight.

Repeated Anova test was used to compare the means of URR, Kt/V and albumin between the groups. We also try to correlate between TCV value with URR and Kt/V, because lost of 20% TCV was correlated with 10% of decrease urea clearance (Gotch, *et al.*, 1999), using Spearman correlation analysis.

RESULTS AND DISCUSSION

Fifty patients agreed to participate in the study, but only a total of 23 people completed the study. We also performed an analysis using uniform length hemodialysis duration (4.5h) with 15 samples, because there was a lack of uniformity duration of hemodialysis.

Patients who followed this research is dominated by the male gender. Etiologies of Chronic Kidney Diseases are most due to chronic pyelonephritis. Blood flow rate ranges between 200-300mL/min.

In statistical test showed that there were no significant difference of the average between URR and Kt / V urea from new dialyzer and dialyzer reprocessed with Renalin with p=0.131 and p=0.373

Because there is a lack of uniformity duration of hemodialysis, we also performed an analysis with a uniform length of time hemodialysis is 4.5h which were obtained by the value of URR and Kt/V urea between the type of tube dialyzer not significantly different with p=0.520 for URR and p=0.784 for Kt/V.

Lobo et al. in a prospective study found that there was no significant difference in the value of Kt/V on repetitive processing up to 6 times using dialyzer type F6 (Lobo *et al.,* 2002). In another study also found no significant difference using cellulose diacetate dialyzer processed manually repeated up to 9 times (Manandhar *et al.,* 2009). Aggarwal *et al.* (2012) using F6 dialyzer polysulfane processed using formaldehyde and reused for 3 times and found no significant difference in the value of URR and Kt/V in to 3 groups of re-use (Aggarwal *et al.,* 2012)

Repeated use dialyzer can cause a decrease in the effective surface of the membrane pore size, depending on the techniques and methods of reprocessing. This can occur even though the residual total cell volume (TCV) remained above 80% of the value of new dialyzer. Decreasing the number of effective volume and pore size caused by formation of a layer of protein that will cause a decrease in urea clearance dialyzer (Ahmad. 2009).

Table I. Number of sample

Dialyser	Sample (Non uniform time)	Sample (uniform time= 4.5h
New	50 people	30 people
1st Reuse	47 people	28 people
4th Reuse	36 people	22 people
7th Reuse	23 people	15 people

Table II. Sample characteristics

Sample Characteristic	N=23 (Non uniform time) Average (SD) /(%)	N=15 (uniform time) Average (SD) /(%)
Age (Years)	44.09 ± 11.7	47.37 ± 11.93
Sex (%)		
Male	56%	53.33%
Female	44%	46.67%
Etiology (%)		
PNC	87%	80%
GNC	9%	13.33%
DMND	4%	6.67%
Dry Weight (Kg)	55.66±11.72	56.78±14.77
Duration (Hour)	4±2.3	4.5
Blood flow (ml/minutes)	251.30 ± 24.22	258.62 ± 25.99
Ultra filtration Volume(Liter)	3.17 ± 1.00	3.09 ± 1.06

Table III. Delivered dialysis dose of URR from new and reuse dialyzer

Dialyzer	URR average ± SD (non uniform time) (N=23)	URR average ± SD (uniform time) (N=15)
New	73.48±7.94	77.47±5.48
1st Reuse	72.58±8.05	76.64±5.96
4th Reuse	73.19±7.56	76.97±5.93
7th Reuse	72.86±8.01	77.07±6.31
P Value	0.131 (Not Significant)	0.520 (Not Significant)

Table IV. Delivered dialysis dose of Kt/V from new and Reuse Dialyzer

Dialyzer	Kt/V average ± SD (non uniform time) (N=23)	Kt/V average ± SD (uniform time) (N=15)
New	1.70±0.38	1.89±0.32
1st Reuse	1.65±0.39	1.86±0.34
4th Reuse	1.66±0.37	1.85±0.38
7th Reuse	1.69±0.41	1.88±0.33
P Value	0.373 (Not Significant)	0.784 (Not Significant)

The accumulation of protein adsorption or blood clot on the membrane, after the process of reuse causing decrease in membrane performance by the presence of a secondary layer of plasma components. It can reduce the diffusion layer and close the pores thereby reducing disposal solute (Azar. 2009 and Canaud. 2014). In this study only used dialyzer qualified TCV above 80%, resulting in the absence of significant differences between URR

and Kt/V urea of new dialyzer and dialyzer reused.

In the measurement of serum albumin was also not found significant differences between the use of a new tube and the tubes were reused by the time of uniform or non-uniform, with p=0.271 and 0.073.

In the study found no significant differences in albumin from the beginning to the end of the study. Albumin levels tend to rise after the hemodialysis process can be seen from the differences of albumin which tend to be positive. This condition is due to the possibility that the increased level of albumin post hemodialysis is due to the reduced concentration of the liquid so that the concentration of serum albumin is increased.

Riyanti (2001) reported that there was obtained a statistically significant difference between the difference of serum albumin in serum pre- and post-hemodialysis for various status dialyzer uses. Aggarwal, *et al* (2012) found no significant differences in serum albumin pre and post on dialyzer repeated use. In another study it was found that there were no significant differences in serum albumin levels through the use of repetitive dialyzer to 13 times (Ahmed *et al.*, 2001).

We also try to correlate between TCV value with URR and Kt/V. because lost of 20% TCV was correlated with 10% of decrease urea clearance (Gotch *et al.*, 1999). Spearman correlation analysis of the results obtained in the weak correlation between TCV relationship with URR values (r=-0.044) and TCV relationship with Kt/V (R=-0.058), with p=0.676 and 0.585 for the URR for TCV. If the samples are analyzed only with uniform time of 4.5h is obtained r value of -0.031 (p=0.813) on the relationship between TCV and URR while the r value of -0.087 obtained (p=0.511)

There were no correlations between the value of TCV with URR values and KT / V urea. This is probably due to the TCV value of new dialyzer is not measured and still considered as 100%. The absent of measurement of new dialyzer TCV on new tubes can result in TCV value becomes less accurate because there is still a possibility that the TCV dialyzer not in hundred percent state.

In addition, the use of repeated dialyzer TCV value is only made up 80% so that the measurement range becomes narrow and no significant decrease in the value of URR and Kt/V urea.

Several studies showed a reduction in the surface area of the protein material dialyzer result of the patient's blood that can lead to decreased clearance of urea. Lobo et al (2002) reported that there is a positive correlation between TCV and Kt/V dialyzer polysulfide (0.71) and cellulose diacetate (0.69). Gotch reported that as much as 20% reduction in total cell volume does not have a significant effect on the clearance of small molecules (Gotch *et al.*, 1999). Studies show that a decrease in the area of the membrane can be partially compensated by increasing the blood flow rate.

Ouseph reported that urea clearance with parameters Kt/V does not change significantly with TCV which is above 80%, but decreased clearance of beta 2 TCV used microglubin although still above 80% (Ouseph *et al.*, 1992). There are several others factors that contributed urea clearance beside Total Cell Volume such as blood flow rate, convective urea flux that occurs with ultra filtration, volume distribution of urea and vascular access.

CONCLUSION

The use of repeated dialyzer does not give effect to the value of Urea Reduction Ratio (URR), Kt/V urea also albumin serum levels of 1st, 4th and 7th reused dialyzer that reprocessed with renalin.

ACKNOWLEDGMENT

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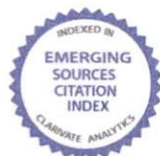
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