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EFFECT OF REPROCESSING CELLULOSE DIALYZER SUBSTITUTED WITH THE PRODUCT R-HYDROGEN PEROXIDE TO CLEARANCE UREA DIALYZER IN CHRONIC HEMODIALYSIS PATIENT

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ABSTRAK

Kerugian pemrosesan ulang dialiser dapat berasal dari faktor sterilitas, paparan bahan kimia yang digunakan selama pemrosesan kembali kepada pasien, perubahan permukaan dan permeabilitas membran secara kualitatif dan kuantitatif, dan hilangnya integritas struktur dialiser. Penggunaan kembali dialiser potensial menyebabkan penurunan klirens toksin uremik dan dapat menyebabkan tidak tercapainya dosis HD yang diinginkan. Penggunaan kembali dialiser (dialyzer reuse) saat ini dilakukan di RSUD Dr Soetomo. Setiap dialiser digunakan sebanyak 8 kali dengan 1 kali pemakaian baru dan 7 kali penggunaan kembali. Hingga saat ini data efisiensi dialyzer yang diproses ulang belum ada, untuk itu penelitian ini dilakukan dengan tujuan mengetahui pengaruh pemrosesan ulang terhadap performa dialyzer dengan menggunakan parameter klirens urea Penelitian observasional yang dilakukan prosprektif di unit hemodialisa RSUD DR Soetomo Surabaya yang bertujuan untuk membandingka klirens urea dialyzer baru dengan klirens urea dialyzer yag diproses ulang dengan produk R dan R-H_2O_2. Sampel penelitian adalah dialyzer yang digunakan oleh pasien dengan diagnosa penyakit ginjal kronis stadium 5 hemodialisis kronis di unit hemodialisis dengan di RSUD DR Soetomo Surabaya yang memenuhi kriteria inklusi. Besar sampel penelitian ditentukan dengan metode quota sampling. Terjadi penurunan klirens urea < 10% pada dialyzer yang diproses ulang dengan R dan R-H_2O_2. Dimana, penurunan kliens urea pada dialyzer yang diproses ulang dengan R-H_2O_2 lebih stabil dengan simpangan lebih kecil dibandingkan dengan dialyzer yang diproses ulang dengan R saja. Pemrosesan ulang dialyzer denga R dan R ditambah Hidrogen peroksida menurunkan klirens urea dialyzer selulosa tersubstitusi. Penurunan klirens urea dialyzer yang diproses ulang dengan R lebih rendah dibadingkan dengan dialyzer yang diproses ulang dengan R dan Hidrogen peroksida. ***(FMI 2012;48:50-53)***

Kata kunci: pemrosesan ulang dialyzer, produk R, hidrogen peroksida, selulosa tersubstitusi

ABSTRACT

Disadvantage of re-processing dialyzer can come of the major factors sterility, presentations chemicals that used during processing back to patients, changes the surface and vascular permeability membrane in qualitative and quantitative, and the loss integrity structure dialyzer. Use back dialyzer causes potential an impairs clearance uremic toxins and can cause could not be achieved dosage HD which is wanted. Use back dialyzer (dialyzer reuse) is done in Dr Soetomo Hospital. Each dialyzer used as much as 8 times with 1 times new usage and 7 times use again. Until this time there is no data of efficiency dialyzer that is processed, so that the research was done in order to find out the influence dialyzer re-processing performance by using parameter clearance urea. Observational experimental that done prospective in Hemodialysis unit DR Soetomo Surabaya that aims to compare clearance urea of new dialyzer with clearance urea dialyzer that is re-processed by the product R and the product R-H_2O_2. Samples is dialyzer that is used by patients with chronic kidney disease diagnostic stage 5 hemodialysis chronic in the hemodialysis unit in DR Soetomo Surabaya who meet the inclusion criteria. Sample size is determined by the method quotas sampling. There was a decline clearance urea < 10% in dialyzer which is re-processed with R and R-H_2O_2 where, the decline of urea clearance in dialyzer re-processed with R-H_2O_2 more stable compared to deviation dialyzer re-processed with R alone. Re-processing dialyzer with R and R added Hydrogen peroxide declines clearance urea substituted cellulose dialyzer. Declining clearance urea of re-processed dialyzer with R is lower compared to dialyzer re-processed with R and Hydrogen peroxide. ***(FMI 2012;48:50-53)***

Keywords: *re-processing dialyzer, product "R", hydrogen peroxide, substituted cellulose*

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INTRODUCTION

According to the Kidney Disease Outcome Quality Initiative (K/DOQI) Chronic Kidney Disease (CKD) is defined as kidney damage, both structurally or functional for 3 months or more, with or without a decrease in Glomerular Filtration Rate (GFR). Manifested as one of the physiological abnormalities or markers of kidney damage that is including abnormalities in blood or urine composition.

Hemodialysis is one of renal replacement therapy that aims to eliminate the remnants of metabolic products (proteins) and excretion disorders of fluid and electrolyte balance between blood and dialysate compartment through a semi-permeable membrane that acts as an artificial kidney/dialyzer (Sukandar 2006). Excreting uremic toxin is one of the main goals HD, therefore one HD adequacy parameters used are urea clearance in addition to other parameters such as urea reduction ratio (URR).

Research on the outcome of HD over the last 20 years was using the clearance of small molecular weight toxins such as urea to represent the adequacy of HD (Leypoldt 2008). Dialyzer urea clearance is affected by the rate of blood flow, the effective time of dialysis, dialysate flow rate, dialyzer used, and the quality of reprocessing dialyzer (Henrich 2009). Until this time there is no data of efficiency dialyzer that is processed, so that the research was done in order to find out the influence dialyzer re-processing performance by using parameter clearance urea.

Dialyzer reprocessing has been performed since the 1960s, and its use is increasing (Henrich 2009). Economic factor is as one of the reasons. A study in Canada stated that reprocessing dialyzer save 3,629 CAD per patient per year, or equivalent to Rp 23,225,600 per patient per year. Another study in Saudi Arabia reported a savings of U.S. $ 18.8 million per person per year (Mitwalli et al 2001). Another advantage of the reuse dialyzer include intradialysis symptom reduction, reduction in the use of SUDS first time/first use syndrome, improve biocompatibility, increased use of dialyzer high flux/high efficiency, and reduction of Limulus amebocyte lysate exposure-reaction material/LAL-RM in use dialyzer first times. Repeated use dialyzer in the United States increased significantly from 18 % hemodialysis centers and 18 % of patients in 1976 to 75 % of hemodialysis centers and 81 % of patients in 1994 (Tokars et al 1997). In Europe only 10 % of patients using reprocessed dialyzer. In Canada, only 15 % of dialysis units that perform reprocessing dialyzer, while in Japan the use of re-dialyzer prohibited by law. In developing countries the reuse dialyzer widely used (Henrich 2009, Manns et al 2002). Until now there is no data of efficiency reprocessed, so that the research was done in order to determine the effect of reprocessing dialyzer performance using urea clearance parameters.

MATERIALS AND METHODS

Observational experimental done prospective in Hemodialysis unit DR Soetomo Hospital Surabaya purpose is to compare between urea clearance new dialyzer with urea dialyzer that is re-processed with R and R-H_2O_2. There are 2 methods used to process the re-use dialyzer. The first, dialyzer processed with R® (contains peracetic acid, hydrogen peroxide, acetic acid) with Renatron® automated dialyzer reprocessing system. While the second method wipe dialyzer off with hydrogen peroxide and processed like process above.

Samples was dialyzer that was used by patients with chronic kidney disease diagnostic stage 5 hemodialysis chronic in the hemodialysis unit in DR Soetomo Surabaya who meet the inclusion criteria. Sample size was determined by the method quotas sampling, which was a fellow determines the amount of sample that meet certain characteristics that is the fundamental characteristics population at experimental period, in this case the number of sample that determined would be taken was 15 dialyzer per re-used groups. The criteria inclusion as follows : dialyzer patients with chronic renal failure diagnosis stage 5 HD chronic, dialyzer that used by patients who signed Informed concent and hemodialysis with the dose heparin 1000 unit/hour. And, the exclusion criteria as follows : Dialyzer that used by patients with HbsAg positive (from secondary data) and dialyzer that used by patients with a history of using dialysate fluid that keep on changing

Hemodialysis which was done regularly scheduled every three years at least 5 days. Dialyzer is Nipro type FB130T GA with volume 75 ml with large surface effective 1.3 m2. New dialyzer is dialyzer that had not had re-processing. Dialyzer Reuse was dialyzer which had been re-processing to 1, to 2, to 3, to 4, 5, 6, 7th with R or R-hydrogen peroxide and met the requirements re-processing (TCV < 80%, do not crack or break). Dialysate Fluid that was used in this research was dialysate fluid acetate. Urea nitrogen levels in the blood that was taken from the lab with enzymatic assay automatically with mg/dL units. Clearance urea was defined as blood volume/plasma that was to be purged of urea per unit time.

The Presentation data about impairs clearance urea include a diagram characteristic samples, the table impairs clearance urea new dialyzer, dialyzer re-processed with R, and dialyzer re-processed with R-H_2O_2, the relationship graphic of amount of re-used with clearance urea in each method. Statistical analysis consisted of the evaluation of data distribution using normality test (test Kolmogorov-Smirnov), comparison of impairs clearance urea new dialyzer, re-processed with R, and dialyzer re-processed with R-H_2O_2 : Mann-Whitney test (if any data is abnormal), and comparison of dialyzer clearance urea in each re-processing in each

method : ANOVA (if any data normal) and Kruskal-wallis test (if any data is abnormal)

RESULTS

From the research has been done that was obtained the level data of blood nitrogen urea on inlet and outlet new dialyzer, re-processed dialyzer with R, and re-processed dialyzer with R-H_2O_2. This research had observe as many as 69 dialyzer consisting of 20 new dialyzer, 32 re-processed dialyzer with R and 17 re-processed dialyzer with R-H_2O_2. Data of Nitrogen urea levels in blood at inlet and outlet dialyzer included into the equation to be counted urea clearance dialyzer. Clearance urea calculated by standard formula. Side clearance of blood counted as (Cbi-Cbo) x (Qb/Cbi), where Cbi was the concentration urea nitrogen at inlet blood (arterial), Cbo was the concentration urea nitrogen at outlets blood (vein), and Qb was the blood stream.

Table 1. Clearance urea new dialyzer, re-processed with R,, and re-processed with R-H_2O_2

Dialyzer		N	Impairs Clearance Urea
New		20	165.59 ± 27.81 (73.68 - 187.23)
Renalin	R1	3	157.39 ± 21.8 (134.4 - 177.78)
	R2	5	153.59 ± 31.51 (110.71 - 176.47)
	R3	8	169.96 ± 13.22 (155-185.19)
	R4	4	167.97 ± 7.67 (177.05-175.76)
	R5	5	165.92 ± 14.41 (144.68-179.07)
	R6	5	163.12 ± 35.31 (100-181.13)
	R7	2	162.57 ± 23.67 (145.83-179.31)
Renalin-H_2O_2	R1	2	177.42 ± 1.35 (176.47-178.38)
	R2	3	177.68 ± 0.81 (176.74-178.18)
	R3	3	176.69 ± 0.81 (176.12-177.05)
	R4	3	176.51 ± 0.89 (175.76-177.5)
	R5	2	174.83 ± 0.67 (174.36-175.31)
	R6	2	172.55 ± 1.59 (171.43-173.68)
	R7	2	171.61 ± 0.25 (171.43-171.79)

From samples above can be discovered that there is a significant difference between urea clearance new dialyzer and re-processed dialyzer done by Mann-whitney test. From test result, obtained as stipulated in the table 2 as follows:

Table 2. Analysis of statistics impairs clearance urea dialyzer

Re-processing method	P
New - Renalin	0.013
New- Renalin- H_2O_2	0.054
Renalin - Renalin- H_2O_2	0.585

To discover the difference between clearance urea in the same re-processing method, will be done different test with Kruskal-Wallis test (R) and ANOVA (R-H_2O_2), so, in the current R there is no difference means urea clearance dialyzer first reuse until 7th reuse (p=0.487). While in the R-R-H_2O_2 obtained the results show that there are huge differences between impairs clearance urea dialyzer re-use in the 1st used with the use 6 (p=0.005) and re-use 7 (p=0.001). Urea clearance dialyzer in use 2 had different means with urea clearance the 6th re-use dialyzer (p=0.002) and with the re-use 7th (p=0.000). Clearance urea dialyzer re-use in 3 different means with impairs clearance urea dialyzer on usage to 7 (p=0.001) and the same thing happened in 4th re-using where urea clearance dialyzer had different means with urea clearance 7th re-use dialyzer (0.002).

DISCUSSION

There was a decline of urea clearance dialyzer in each dialyzer re-processing method from reuse to 1 to 7th. In the group R-H_2O_2 there are huge differences between R1 and R2 with R6 and R7 also R3 and R4 with R7. Depending on processing techniques and dialyzer re-processing methods can cause experienced the declining of the effective surface from the membrane dialyzer due to a decrease in the number of and size pores. This can happen even though residual total cell volume (TCV) is still above 80% of the new dialyzer. Adsorption plasma protein on the surface diasetat cellulose membrane can form a new layer (layer proteins) that can reduce the size of the membrane pores dialyzer so effectiveness membrane to be able to move the toxin/solut around decreased (Leypoldt et al 1998). Decreasing of a number of effective volume and pore size, due to this protein layer formation that caused decreasing of urea clearance dialyzer. This is supported with the research reported that seen using technical description with magnetic resonance speed (magnetic resonance velocity imaging technique) happens obstruction in fiber membrane dialyzer (Zhang et al 1995).

There was a decline in complementary activation in dialyzer made by cellulose which is re-processed with perasetat acid, that was suspected to be deposit fragments C3 and plasma protein at the membrane surface that is not cleared during re-processing with R hamper ties into fragments C3 for activation complement (Cheung et al 1991). Dialyzer re-processed with R-H_2O_2 shows decreasing of clearance more stable, with a smaller deviation compared to re-processed dialyzer with R alone. Urea clearance dialyzer that was re-processed with R-H_2O_2 is no different means from that new dialyzer. While in the R group there is huge difference that compared to urea clearance of new dialyzer. Additional hydrogen peroxide can improve the re-processing quality dialyzer that is to eliminate the protein layer and clotting blood that are not able to be relieved completely by R. Re-processing with R-H_2O_2 there is a drop of water excretion and solut (urea, creatinine, inulin, vancomycin) which means after reuse to 15 ($p<0.05$) (Scott et al 2010).

CONCLUSION

There is a decreasing of urea clearance < 10% in dialyzer re-processed with the products R and R-H_2O_2. The decline urea clearance in dialyzer that was re-processed with R-H_2O_2 more stable with smaller deviation compared to dialyzer that is re-processed with R alone. There are huge differences between urea clearance of new dialyzer with dialyzer re-processed with R. In contrast, there is no significant difference between urea clearance new dialyzer with dialyzer re-processed with R-H_2O_2.

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