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Performance Hemodialysis Instrument Influenced Conductivity

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Abstract
The kidneys play a role as a regulator of the water balance, regulate the concentration of salt in the blood and acid alkaline balance of the blood. To reduce the levels of toxins in the body then it is done washing the blood. The principle of washing the blood (hemodialysis) is putting the blood side by side with rubs (dialysate) separated by a thin membrane called the membranes semi-permeable. The process of washing blood utilizing the principle Reserve Osmosis, namely dialysis liquid which are on one side flows the opposite direction with a mixture of molecules of blood on the other side of the tube. The pressure dialysis immediately forcing useless material in the blood sticks to the surface of the membrane semi permeable. Through this system, tube replacement kidney or dialyzer tubes especially designed with a semi permeable materials can filter content that is useless in the blood detrimental.In order to fulfill the work quality of the hemodialysis instrument so noteworthy the factors that affect the value of the conductivity of the hemodialysis instrumentation. These factors, among others, the source of water used, the carbon and resin, and system RO (Reverse Osmosis).
Keywords: Hemodialysis Instrumentation, Conductivity

1. INTRODUCTION

The organization of health services to the community are carried out in hospitals largely determined by the availability of hospital facilities. Hospital facilities need to be at their best and was owned directly to always have to be in a State worth sharing so ready for working continuity and guarantee the quality of health services. The facilities of the hospital are the hospital hardware includes the means, tools and equipment used for service. Health equipment is one of the supporting factors are very important in the Organization of health services. Therefore the condition as well as the function of the tool should be good health and able to support the service. To achieve this, it should be done with good equipment management and continuous improvement. In this case the maintenance is done by the hospital electromedic technician. With the rise in sufferers of kidney failure, then the use of hemodialysis machines increased. The development of hemodialysis machine is still constantly looking for innovations that are more secure and convenient for patients.

The time or duration of hemodialysis tailored to individual needs. Each hemodialysis is done 4-5 hours with a frequency of 2 times a week. Hemodialysis should ideally be done 10-15 hours/week with QB 200-300 mL/min. At the end of the interval of 2-3 days between hemodialysis, salt, water, and pH balance already are not normal again. So the service of hemodialysis is a health service that is "Life Saving and Long Time" due to kidney function that can not work properly.

Because the service of hemodialysis is "Life Saving and Long Time" then for expedited service and avoid the risk of a fatal namely recent blood washing services due to damage to the machine caused by delayed repairs and maintenance. Hemodialysis machine repair is required quickly completed due will result in the patient's blood washing schedule pending. Hemodialysis machine repair is very important in the evaluation of the adequacy of hemodialysis. The degree of public health need to be enhanced through quality health services. One of them is through the efforts of the provision of hemodialysis machine is good, safe and be eligible to use. With respect to the increasing cases of chronic kidney disease (PGK) resulting from factors cause is infection. Then with the case above, the development of technology to wash blood haemodialisis increasingly sophisticated. Hence the need for supervision attached to the tool so that the blood can be maximum washing system. The result of a maximum blood-washing indicator is a presence test laboratory or post HD. As for the system of washing the blood is ultravisasi, diffusion and osmosis. The principle of blood-washing (hemodialysis) is putting the blood side by side with rubs (dialisat) separated by a thin membrane called the membrane semipermiabel. This membrane can be bypassed to small molecules but prevents the passage of large molecules. There are several factors that affect maximum hemodialysis instrumentation work. One of them is through the efforts of the provision of hemodialysis machine is good, safe and be eligible to use. With respect to the increasing cases of chronic kidney disease (PGK) resulting from factors cause is infection. Then with the case above, the development of technology to wash blood haemodialisis increasingly sophisticated. Hence the need for supervision attached to the tool so that the blood can be maximum washing system. The result of a maximum blood-washing indicator is a presence test laboratory or post HD. As for the system of washing the blood is ultravisasi, diffusion and osmosis. The principle of blood-washing (hemodialysis) is putting the blood side by side with rubs (dialisat) separated by a thin membrane called the membrane semipermiabel. This membrane can be bypassed to small molecules but prevents the passage of large molecules. There are several factors that affect maximum hemodialysis instrumentation work.

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The principle of washing the blood (hemodialysis) is putting the blood side by side with rubs (dialysate) separated by a thin membrane called the membranes semi-permeable. The process of washing blood utilizing the principle Reserve Osmosis, namely dialysis liquid which are on one side flows the opposite direction with a mixture of molecules of blood on the other side of the tube. Pressure dialysis immediately forcing useless material in the blood sticks to the surface of the membrane semi permeable. Through this system, tube replacement kidney or dialyzer tubes especially designed with a semi permeable materials can filter content that is useless in the blood which is detrimental. Purpose of this research is to know the major measurement errors that occur on the conductivity measurement is done on each then tool hemodialysis.

2. RESEARCH METHOD

This research was experimental research that was conducted in the field with the design of posttest only control group. The subject of this research was conductivity measurement done on each tool hemodialysis. The procedure of this research was descriptively measurement errors that occur on the conductivity measurement is done on each then tool hemodialysis .

3. RESULT AND DISCUSSION

The principle of Dialyzer in Hemodialysis

a. Ultra Filtration

- Water moves from the blood to the dialysate is the result of pressure high hydrostatic between these two compartments.
- The transfer of water and dissolved materials because of the difference in hydrostatic pressure in the blood dialysate is influenced by the forces of osmosis.

b. Difusion

- A low molecular movements through high-speed
- A big molecular movements through low-speed
- The migration of dissolved materials due to differences between the levels of blood and dialysate.
- The higher levels (concentrations) of blood the more materials that move into dialysate are influenced by changes in concentration, molecular weight and durability of the membrane

c. Osmosis

The movement of water through the membrane because of osmolalitas blood and dialysate is affected by osmotic pressure.

d. Reverse Osmosis

The influence of high pressure that resulted in the transfer of water through the semi permeable membrane can move normally due to osmotic power. This process is used to prepare water coming into dialysis.

e. Convection

- The migration of dissolved materials through membranes due to the migration solution.
- Dissolved substances only moved due to the pull of the solvent

Dialysat

Dialysat is a liquid that is opposite the blood membrane. Dialisat is composed of water, electrolytes and other subtances namely Sodium, potassium, Calcium, Magnesium, Chloride, Glucosa, Lactic, or bicarbonat Acetat. Dialisat made in a concentrated, it mixed with water to obtain fresh dialisat with comparison 1:34. Desired subtances as much as possible from blood drawn as ureum, creatinin, uric acid etc, is not found on the fresh dialysat.

Water

The water used to make the dialisat must be as clean as possible water or pure may be. Therefore the necessary process of purifying water (water treatment) and must fulfill the standard A.A.M. I (Association for the Advance of Medical Instrumentation).

Reverse Osmosis Water

Reverse Osmosis Water or often called RO water is water used for blood-washing process. With accompanied by pressure and control, this water flowed into Hollow Fiber after mixing with other substances so that will produce liquid with conductivity have been determined according to standards . Water is very important because water is directly related to the Hollow Fiber that would filter the human blood. For this water should really fulfill certain requirements including,

a. Water source comes from ground source or PAM

b. The water source must be made water purification (water treatment) with a Reverse Osmosis system to produce fresh dialysat
c. Flow Velocity, temperature and levels of chemicals, gas should be monitored
d. The composition of the RO water should be monitored and fulfill the standard A.A.M. I (Association for the Advancement of Medical Instrumentation)
e. Water pressure should be measured for the delivery of water to the dialyzer machine. RO Water is not water for public consumption. Due to the manufacturing process and its use is causing this water is hard to gained. Perhaps only at hospitals that use the Hemodialysa facilities. Making this water through the myriad stages of purification that ultimately gained a high level of hygiene with water that is free of bacteria, sludge, carbon materials and other harmful substances.

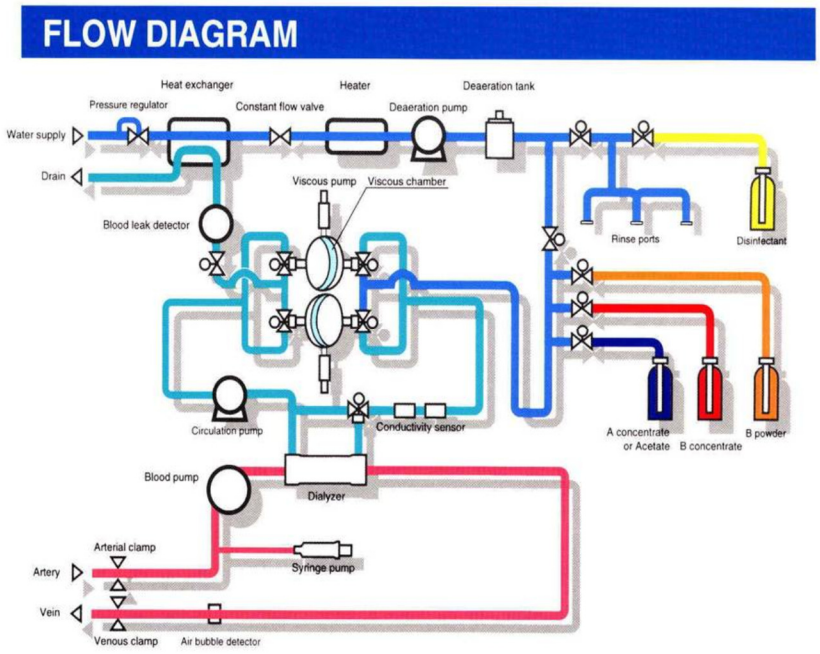

Figure 1 The flowchart of Hemodialysis Instrumentation

Hemodialysis machine using Volumetric Dialysate Balancing System, where this system is a closed system. Incoming and outgoing dialysate from dialiser governed by viscous chamber . Clean water (RO) goes through Water Inlet Filter, when the machine is turned on (switch to ON) open the water inlet filter, clean water will flow into the pressure regulator. Pressure regulator serves to regulate the water pressure that goes on dialysis and then adjusted and displayed the heat/water temperature of RO, and clean water that has already adjusted the temperature will go on constant flow valve, i.e. it serves to determine a.k.a./ faucets for water flow on a permanent basis and in accordance with the setting of the water, the water after controlled by faucets/a.k.a. then water will be heated with the heater in accordance with the settings specified by the operator. Then pumped by deaeration pump to determine how big the discharge of water per minute and accommodated to the deaeration tank, used to wash rinse pipelines are exposed to dirt or crystallisation of the remnants of a solution of bicarbonate, in It's been cleaned up or in the rinse still error too and still dirty then we do with a solution of disinfectan used to clear fat-fat/crust that exists inside the tubing.

Then on A ragen (acid) and B (bicarbonate) and pumped through a valve which then accommodated in viscous chamber, at the chamber is used for mixing of reagent A (acid) and B (bicarbonate) and water, after reagent A (acid), B (bicarbonate) and water mixed then viscous pump is used to determine how much flow rate out, then a lot of reagent A (acid), B (bicarbonate) and censored by the water conductivity sensor.

After the conductivity is achieved then the dialysate will go on dialiser (artificial kidney) on this process occurs the process of diffusion, Osmose and Ultrafiltrasi against the blood from a patient, then the process of blood flow is from the patient's artery vessels pumped by blood pump in this process have mixed blood by heparin reagents that function so that the blood did not experience freezing when dialysis process takes place. After being pumped by the blood in the blood will flush pump on dialiser (artificial kidney). The process of dialysis of the blood will be returned on the patient's blood before it was censored, by air bubble detector to ensure that blood to the patients there are no air bubbles, then after certain clear of bubbles then blood will inserted through the venous vessels. Then water and dirt in the blood the rest of dialiysis pumped by a circulation pump that will pass through the valve-valve and the remains of the water and the dirt that was censored by the blood leak detector that is

enabled for the presence of blood that leaked out and went on a liquid coming out of the patient's blood, so that certainly will not be wasted. UF Pump draws liquid from the system with the volume of 1 ml per stroke. At the time of system in the closed condition, then the volume of the same ultrafiltrasi will flow back from the blood through the dialyser.

Hemodialysis instrument with a range of different minimum and maximum at its conductivity. So obtained the following results:

Table 1 Conductivity measurement data on Tool A with minimum-maximum conductivity range (12.6 – 14.1) mS/cm

Machine Number	**Setting Resin**	**Range Min-Max Conductivity (12.6 - 14.1)mS/cm**
A	**(0)**	**SetingConductivity (13.6) mS/cm**
X1	0	13.6
X2	0	13.5
X3	0	13.5
X4	0	13.6
X5	0	13.5

From the results of measurements of the above writers will further analyze the data measurement results using SPSS Software.

Table 2 Descriptives at conductivity 13.6 mS/cm

			Statistic	Std. Error
Instrument A	Mean		13.5400	.02449
	95% Confidence Interval for Mean	Lower Bound	13.4720	
		Upper Bound	13.6080	
	5% Trimmed Mean		13.5389	
	Median		13.5000	
	Variance		.003	
	Std. Deviation		.05477	
	Minimum		13.50	
	Maximum		13.60	
	Range		.10	
	Interquartile Range		.1000	
	Skewness		.609	.913
	Kurtosis		-3.333	2.000

Table 3 Case Processing Summary at conductivity 13.6 mS/cm

	Cases					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
Instrument A	5	100.0%	0	.0%	5	100.0%

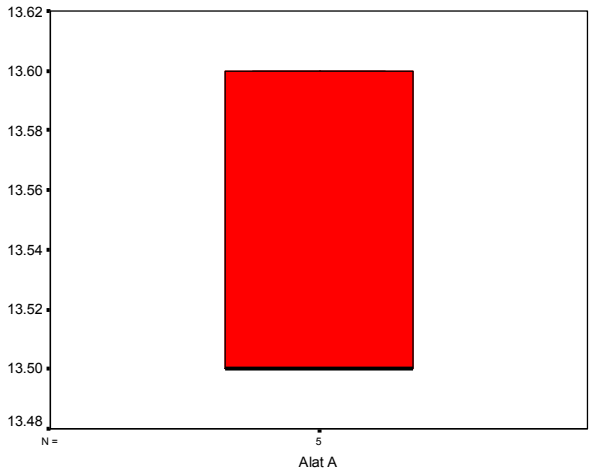

Figure 2 Histogram graph on conductivity 13.6 mS/cm

From the graph above, the histogram on the conductivity range (12.6-14.1) mS/cm at a particular range of distributed image above and still fit in the specified range area although the range limit of the highest conductivitynya 3.6 mS/cm Tools with Stem-and-Leaf Plot

From the measurement results above the average value obtained was 13.54 mS/cm, so there is a difference between 0.06 mS/cm of the settings that have been specified 13.6 mS/cm.

- Deviations (corrections)

  Formulated as follows :

  $$\text{Deviations} = \overline{X} - Xn$$

  Deviations = seting-average

  13.6 – 13.54 = 0.06

  The difference from the average value of the desired price with the value measured is also small i.e. 0.06.

- % Error

  Formulated as follows :

  $$\% \text{ Error} = \frac{Xn - \overline{X}}{Xn} x100\%$$

  = 0.44 %

  So an error (% Error) = 0.44% and the value of the percent it is a Byway (Error) of the desired value.

- Standard Deviasi (SD)

  Formulated as follows :

  $$SD = \sqrt{\frac{\sum (X - \overline{X})^2}{n-1}}$$

And from the results of the above calculation of the standard deviation values obtained from real tools 0054. a value that indicates the level (degree of) data group or size variations of the standard deviations from the mean. If the standard deviation of the smaller then the data the more precision.

Uncertanty (Ua)

Formulated as follows :

$$Ua = \frac{SD}{\sqrt{n}}$$

The value obtained is the uncertainty of the estimates about 0.024 i.e. measurement results which contained the correct price.

- U_{95}

  Formulated as follows :

  $$U_{95} = Ua * 2{,}57$$

  = 0.061

Estimates regarding the measurement results of which there is the correct price. Is the result of the multiplication between uncertainty with 2.57 2.57, where is the Statute. U95 shows data that are considered true is 95%.

4. CONCLUSION

To have approached both the measurement results and especially to the existing range of conductivity on A tool with the settings made on the measurement of conductivity, in as much as 5 times indicates that the influence the water in the system of work hemodialisa engine is still in good condition and is still eligible to use.

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