QUALITY ASSESSMENT OF DIALYSIS WATER

Authors Name: Sameera Shaheen ,
M.Sc. Nutrition & Dietetics
Anwar Ul Uloom College
Hyderabad ,India
Sameera.shaheen789@gmail.com

Authors Name: Nazia Mohammadi
H.O.D, M.Sc. Nutrition & Dietetics, Ph.D.
Anwar ul uloom college
Hyderabad, India
naziamohammadibwy@gmail.com

Authors Name: Summaya Ahmed ,
M.Sc. Nutrition & Dietetics
Anwar Ul Uloom College
Hyderabad ,India
Summayaahmed87@gmail.com

Authors Name: Sophiya begum
M.Sc. Nutrition & Dietetics, Ph.D.
Anwar ul uloom college
Hyderabad, India
sophiyabegum6@gmail.com

ABSTRACT

Dialysis water, also known as dialysate, is a special type of water used in the dialysis process. Dialysis is a medical procedure that helps remove waste products and excess fluid from the blood when the kidneys are unable to do the job adequately. Dialysis water is thoroughly purified and treated to ensure its safety and suitability for the dialysis process. It is produced by water purification systems that remove impurities including minerals, bacteria, viruses and other contaminants. The purification process usually involves several steps such as filtration, reverse osmosis and deionization .Two water samples are collected directly from RO plant sources as in WC.R outlet storage tank into one litre biseleri package water bottle and + clarifications .The method used in lab is **Desired testing tailor test,** .and code package (TTP).The physical attributes and the mineral composition water are under permissible unit as per WHO guidelines. According to Indian government haemodialysis guidelines, acceptable limits of bacterial contamination of treated water and dialysis were considered below 200 CFU/ml and below 2000 CFU/ml, respectively.

KEY WORDS:- Dialysis water ,Dialysate, Deionization , RO, Haemodialysis , Contaminants ,Bacteriological ,Purification.

I. INTRODUCTION

(a) WHAT IS DIALYSIS :-

Dialysis could be a therapeutic treatment that's utilized to expel overabundance waste and liquid from the blood when the kidneys are not working legitimately. The treatment includes employing a uncommon machine to channel the blood exterior the body, expelling squander items and overabundance liquids, and after that returning the sifted blood back to the body

(b) REQUIREMENTS OF DIALYSIS:-

Dialysis is a treatment necessary for patients with kidney failure. Kidney failure is a condition in which the kidneys can no longer perform their normal functions, such as filtering waste products and excess fluid from the blood, maintaining fluid and electrolyte balance, and producing hormones that regulate blood pressure and red blood cell production

(c) FUNCTION OF DIALYSIS :-

During dialysis, two fluids separated by a porous membrane exchange those components that are small enough in size to diffuse through the pores. When blood contacts one side of such a membrane, solutes (including inorganic salts and urea) pass through the sterile solution placed on the other side of the membrane. Because the particles are too large, white and red blood cells, proteins and platelets cannot pass through the membrane. To limit or prevent the diffuse loss of substances necessary for the body, such as amino acids, sugars and necessary amounts of salt, such compounds are added to a sterile solution; therefore, their diffusion of the blood is

replaced by a uniform movement in the opposite direction. The lack of diffusible substances in the blood can be corrected by adding them to the solution where they join the circulation.

Although water easily passes through the membrane, it is not removed by dialysis because its concentration in blood is lower than in solution in fact, water tends to move from the solution into the blood.

The dilution of blood that results from this special process is prevented by ultrafiltration, where some water, together with some solutes, is forced through the membrane, keeping the blood at a higher pressure than the solution.

(d) TYPES OF DIALYSIS:-

There are three primary and two secondary types of dialysis

PRIMARY DIALYSIS:-

Haemodialysis:-Haemodialysis is a type of dialysis that uses a machine to filter blood outside the body. During haemodialysis, the patient's blood is pumped through a dialysis machine, where it is filtered to remove waste products and excess fluid. The clean blood is then returned to the body through a vein or catheter. Haemodialysis is usually performed in a hospital or dialysis centre and requires several hours of treatment three times a week. There are two types of haemodialysis **(A) In-center hemodialysis ,(B) Home Dialysis**

Peritoneal dialysis (PD) :-Peritoneal dialysis (PD) is a treatment method for patients with severe chronic kidney disease. Dialysis technology that uses the patient's own tissue as a filter - the peritoneum inside the abdominal cavity.There are two types of peritoneal dialysis **(A) Intermittent peritoneal dialysis (IPD),(B) Continuous cyclic peritoneal dialysis**

Hemofiltration Dialysis:- . Hemofiltration is a renal replacement therapy which used to treat kidney failure patient but may be of benefit in multiple organ dysfunction syndrome or sepsis. In this process, the patient's blood is passed through a set of tubes via equipment to a semipermeable membrane where waste and toxins are removed from your blood. Replacement fluid is added and the blood is returned to the patient's body

SECONDARY DIALYSIS:-

Hemodialysis:-In hemodialysis treatment with hemodiafiltration, more water is removed from the blood than during normal dialysis. The process helps remove larger toxin particles that are not always filtered out during standard dialysis. After removing excess water and toxins, the hemodiafiltration machine replaces the water with a purified electrolyte solution and then returns the treated blood to the body. hemodiafiltration as a treatment for some CKD patients. It is an effective way to treat kidney failure, but it can also prolong life. In a study presented at the European Association for Dialysis and Transplantation, researchers found that patients with kidney failure who received hemodiafiltration had a 35 percent reduction in mortality compared to those who did not.

Intestinal dialysis:- Intestinal dialysis adds soluble fiber to the diet, such as gum arabic, which is broken down by flora in the large intestine, increasing the amount of nitrogen that is excreted as faecal waste. When acacia fiber was added to a low-protein diet in children with advanced CKD without access to dialysis, their serum BUN levels were slightly lower and their uremic symptoms were reduced. Although it seems to be much less feasible than PD or HD, it can be valuable with limited resources.

(e) BENEFITS OF DIALYSIS:-

Removes waste products: Dialysis helps remove waste products from the body such as urea, creatinine and excess electrolytes that accumulate when the kidneys are not working properly.

Maintains fluid balance: Dialysis helps remove excess fluid from the body and maintain fluid balance, which is important for patients with kidney failure who may develop edema and high blood pressure.

Relieves symptoms: dialysis can relieve symptoms such as nausea, vomiting, fatigue and shortness of breath that can be caused by kidney failure.

Improves quality of life: Dialysis can improve the quality of life of kidney failure patients by helping them maintain energy levels, appetite and sleep patterns.

Enables flexibility: dialysis can be performed in a variety of locations, including at home, allowing more flexibility and comfort for patients. Helps prolong life: Dialysis can help prolong the lives of patients with kidney failure who would otherwise not survive without it.

In general, dialysis is an effective treatment option for patients with kidney failure and can improve their quality of life and prolong their life

(f) DISADVANTAGES OF DIALYSIS:-

Time consuming: Dialysis treatment can be time consuming, with each treatment session lasting several hours. Patients may need to plan their lives while on dialysis.
Risk of infection: dialysis requires the use of medical equipment, which increases the risk of infections such as blood infections and peritonitis.
Dietary restrictions: Dialysis patients may need to follow a strict diet to prevent complications such as fluid overload and electrolyte imbalances.
Side effects: Dialysis treatment can cause side effects such as low blood pressure, nausea, seizures and headaches. Emotional impact: Dialysis treatment can be emotionally draining for patients, who may experience depression, anxiety and reduced quality of life.
Expensive: Dialysis treatment can be expensive and may not be covered by insurance or government programs in some countries.
It is important to note that not all patients with kidney failure require dialysis, and the benefits and risks of treatment must be carefully weighed individually

(d).Dialysis water :-

The dialysis water is used to make the dialysis solution, which is the liquid that flows through the dialyzer and comes into contact with the patient's blood during treatment. Dialysis water must meet strict purity standards to ensure the safety and effectiveness of the dialysis procedure. Dialysis water goes through a purification process to remove impurities that are harmful to the patient, including bacteria, viruses, chemicals and minerals. It is usuallyprocessed through a combination of filtration, reverse osmosis and deionization to achieve the required degree of purity.The exact composition of the dialysis solution, including the concentrations of various electrolytes and other components, is tailored to the needs of each patient and is carefully monitored by healthcare professionals during dialysis treatment. By monitoring the composition of the dialysate, it is possible to achieve the desired electrolyte balance, fluid removal and waste removal.

(e).Sources of Dialysis Water:

In relation to dialysis, the water used to make dialysate, which is the fluid used in dialysis machines, must meet specific quality standards to ensure patient safety. Here are the most common water sources used in dialysis:
Reverse Osmosis (RO) Water: Reverse osmosis is the most commonly used method for water purification in dialysis centres. It involves passing water through a semi-permeable membrane to remove impurities including minerals, bacteria, viruses and other impurities. RO water is considered the gold standard for dialysis because of its high purity.
Deionized water: Deionization is another process used to purify dialysis water. It involves removing ions and charged particles from water by passing it through ion exchange resins. Deionized water is often used in conjunction with other purification methods such as carbon filtration or reverse osmosis to achieve the desired water quality.
Distilled Water: Distillation is the process of heating water to produce steam, which is then condensed back into a liquid. This method removes impurities including minerals, bacteria and some chemicals. Distilled water can be used for dialysis, but is less common than RO or
deionized water. It is important to note that regardless of the water source used, dialysis centres follow strict water purification practices to ensure that the water meets quality standards set by regulatory bodies such as the Association for the Advancement of Medical Instruments (AAMI) and the International Organization for Standardization. for standardization. Standardization (ISO). These standards define maximum allowable contaminant levels in dialysis water to protect patients from potential harm.

II. METHODOLOGY

A.SAMPLE COLLECTION:- Water samples are collected directly from the RO plant outlet storage sources as in WCR tank into empty one litre bisleri packaged water bottle and given to laboratory

B.SAMPLE VOLUME :-A One litre sample is generally sufficient for most physical and chemical analysis however the quantity may be varied depending upon the type of analysis method used etc
1.Color is based on 183025 Part-4 platinum cobalt visual comparison, Colorless 0 Hazen Unit (PCU)
2.Odor rating by lab personnel: Odorless, Agreeable or Disagreeable (Unpleasant or Offensive)
3.Turbidity est, as in 183025P110, using H198703 Nephelo-Turbidimeter. NTU-Nephelometric Turbidity Unit.
4.pH value at 25°C is as measured by Hanna H12002-02Edge (pH) instrument. 5.EC at 25°C measured by Hanna H12003-02EdgeEC. The reference value in this case is as specified by the Central Pollution Control Board (CPCB). TDSE range 0.5EC-0.75EC.

C.BACTERIOLOGICAL ANALYSIS:-TVC pour plate method, using tryptic soya agar, and 48 hours incubation at 35 C to 37 C PHYSICAL AND SENSORY CHARACTERISTICS :-PREPARATION OF MEDIUM FOR BACTERIOLOGICAL ANALYSIS PRESENT IN THE DIALYSIS WATER SAMPLE:-

D. PREPARATION OF REAGENT :- Reagent Preparation Liquefy BD Tryptic Soy Agar (Bottled Media) by heating in an autoclave or steam cooker. Alternatively, the bottle may be placed into a jar containing water, which is placed on a hot plate and brought to boiling. Slightly loosen the cap before heating to allow pressure exchange.

Warning: it is not recommended to use microwave ovens for liquefaction of the medium. Do not place media bottles with metal closures into a microwave oven.

E.SPECIMEN TYPES:- The unsupplemented medium, poured into Petri dishes is used in a variety of procedures, e.g.. for pharmaceutical tests. In clinical microbiology, it must not be used as an isolation medium for pathogens from clinical specimens, unless supplemented with blood (e.g., 5% sheep blood). If supplemented with 5% blood, the plated medium can be universally used for primary isolation of pathogens from all types of specimens. Consult the references for specimen collection and 4.10 processing. The tubed, slanted medium must not be used directly with clinical specimens but only for the growth and maintenance of bacterial cultures.

F.TEST PROCEDURE:- Before use, agar surfaces of the completed medium (in Petri dishes or in tubes) should be smooth and moist, but without excessive moisture because this could cause confluent growth. Consult the appropriate references for specific methods.25,7
Plates supplemented with blood: Streak the specimen as soon as possible after it is received in the laboratory. The streak plate is used primarily to isolate pure cultures from specimens containing mixed flora. Alternatively, if material is being cultured directly from a swab, roll the swab over a small area of the surface at the edge; then streak from this inoculated area. Incubate the plates or tubes under the conditions chosen.
If used for clinical specimens, incubate for 18 to 48 hours (or longer if necessary) at 35 +/- 2° C or as appropriate for the organisms.
If used for hygiene monitoring, incubate at 30 to 35° C, for up to 5 days. If used for pharmaceutical materials, consult the references. 12
The slanted medium in tubes is used for the cultivation and maintenance of bacterial cultures Streak the strain directly of after suspension in sterile water or saline onto the whole slanted surface. Incubate as appropriate for the isolate. During incubation, caps may be slightly loosened to allow venting. After incubation and during storage, close completely.

G.PERFORMANCE CHARACTERISTICS AND LIMITATIONS OF THE PROCEDURE
BD Tryptic Soy Agar is used in a variety of industrial microbiology procedures, e.g., in microbial limit testing and in water and food microbiology 13,67
Un supplemented Tryptic Soy Agar is used for cultivation of many less fastidious bacteria, e.g.. Enterobacteriaceae, nonfermenting Gram negative rods (Pseudomonas and many others). enterococci, staphylococci, spore forming bacteria (Bacillus and related genera), and other organisms with similar growth requirements. The medium is not suitable for the isolation and cultivation of very fastidious bacteria, such as Neisseria or Haemophilus species, or other organisms with special nutritional requirements, and it is not an optimal medium for the isolation of fastidious strict anaerobes. Therefore, the use in clinical microbiology is limited to special tests, e.g., the differentiation of Haemophilus with X. V, and XV factors strips.
Tryptic Soy Agar supplemented with blood (e.g., 5% sheep blood), is frequently used as a primary isolation medium for aerobic bacteria in clinical microbiology. For details, consult the references.3 3-5.8-10
Un supplemented Tryptic Soy Agar does not contain compounds that actively neutralize disinfectants or preservatives. If materials containing such compounds or surfaces that have been previously disinfected shall be

monitored, it is recommended to use Tryptic Soy Agar with Lecithin and Polysorbate or to supplement the medium appropriately.

III. RESULT

A.SAMPLE A (PATIENT A):- The Physical & Sensory characteristics i.e color, is (<1is) , odour is acceptable, Turbidity (0.1) is under permissible levels, pH at 25 C is (6.5) p H value is in acceptable levels and electrical conductivity is 9
The chemical characteristics such as sulphates and nitrate-nitrogen levels is not analysed in the sample.
The Calcium level is observed as 0.40 which is satisfactory
The chemical contamination such as total chlorine is 0.00 which is satisfactory.
The Bacteriological analysis used is TVC which is found to be 7 cfu/ml

B.SAMPLE B (PATIENT B):- The Physical & Sensory characteristics pH at 25 C is 6.3 ; p H value which is no relaxation ; electrical conductivity is 0
The chemical characteristics such as total hardness is below detection level, Calcium
The Bacteriological Analysis used is Total Viable Count (TVC) which is found to be 12 cfu/ml.

IV. CONCLUSION

Based on the results samples were found to be free from contamination. Compare to the two samples, sample B (xyz hospital) is considered to be best for dialysis purpose because it is free from all types of contamination, its physio-chemical characters are under permissible units and is free from any kind of risk factors.

V. REFERENCES

[1] K C Gurudev ,Shalini ashok naik, ,Shiva verma ,V A Indumathi, "Bacteriological Quality of Treated Water and Dialysate in Haemodialysis Unit of A Tertiary Care Hospital 2015''
[2] Saadi kadhim Al-Naseri ,Yasamen Raad Humudat, " Evaluation of Dialysis Water Quality at Hospitals in Baghdad, Iraq 2020"
[3] Caprice Vanderkolk RN, MS, BC-NE , Dawn England MPH, CPHQ ,Pui-Ying Iroh Tam MD, ETAL , "Improving water quality in a dialysis unit using root cause analysis 2017"
[4] Mohammad Saleh Ali Taleshi, Farhad Nejadkoork,Hamid Reza Azimzadeh, Seyedeh Mahdieh Namayandeh,Motahhareh Sadat Namayandeh ETAL, "The Quality of Dialysis Water: A Case Study in the Educational Hospitals of Yazd, Iran 2015"
[5] **:-**Marta Dąbrowska-Bender, Grażyna Dykowska, Wioletta Żuk, Magdalena Milewska, and Anna Staniszewska, " The impact on quality of life of dialysis patients with renal insufficiency 2018''