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Effective management of water in dialysis augments better outcomes

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Water is the foundation of life making it a perfect breeding ground for infection, microbial growth and antibiotic resistant pathogens. Water, also being the foundation for dialysis, plays the most important role for successful patient care.

During an average week of dialysis, a patient can indirectly be exposed to 300-600 litres of water, providing multiple opportunities for potential patient exposure to waterborne pathogens. Renal healthcare facilities generally have large complex water systems that when poorly maintained, can introduce additional risk of infusing these waterborne pathogens.

Adverse patient outcomes including, outbreaks associated with water exposure in dialysis settings, have resulted from patient exposure to water via a variety of pathways, including improper formulation of dialysate with water containing high levels of chemical or biological contaminants and reprocessing of dialysers with contaminated water. For the health and safety of patients, it is vital to ensure the water used to perform dialysis is safe and clean.

Common signs that the water is not meeting the standards are, amongst others:

- Too much calcium or magnesium can cause nausea, vomiting, muscle weakness, severe headaches, skin flushing and low or high blood pressure.
- Metals can cause a variety of symptoms including liver damage, inflammation of the pancreas, destruction of red blood cells, seizures, brain damage and even death.
- Pesticides and fertilizers can cause headaches, dizziness, convulsions and heart and liver damage.
- The chemicals added to destroy bacteria will destroy red blood cells if they enter the blood stream.
- Bacteria and endotoxin can cause infections and fever.
- Overexposure to fluoride can cause abnormal hardening of bones, as well as nausea and vomiting, muscle twitching, low blood pressure and seizures.

Once water enters a dialysis centre, the goal is to achieve high quality and safe permeate and dialysate. It is estimated that many reactions to inadequately treated water go unreported because the chronic symptoms of kidney disease, mineral bone disorder or chronic inflammation, which can be insidious and attributed to problems secondary to end stage renal disease (ESRD), unless a patient exhibits an acute or sub-acute reaction.

Like any water management system, Reverse Osmosis - being the first choice for water disinfection in dialysis - is susceptible to failure without accurate monitoring. A renal healthcare facility can trust that the water treatment system is running smoothly, and that dialysis water is adequately pure, only through collaboration and verification with an

experienced and efficient team. This team needs to consist of specialists with a sound understanding of process design, reverse osmosis technology and hygiene (micro) management.

Correctly designing an RO plant (proper process engineering) allows the plant owner (customer) to extract as much as 80-85% efficiency out of the plant. This means that for every 100l of raw water taken from the municipality to feed the RO plant, 80-85l is permeate that can be used in the dialysis process.

Proper disinfection and cleaning procedures are vital and the correct micro biological process compliance to validate water quality, must be done in a controlled and trained environment. Correctly maintained mechanical equipment and calibrated instruments are important for the longevity of a plant and the accuracy of analysis. Maintenance is key and it is underpinned by quality after sales services and maximum return on the investment.

The performance of the RO is heavily dependent on the incoming water and its make up. Higher than normal levels of salts will reduce the quality of your treated water as well as the overall efficiency of the plant, not to mention damaging the actual RO membranes if the system is overworked.

Donavan Hendricks, Director of Enaqua

“There is 'pre-analysis' to correctly size a plant and then there is 'post analysis' or analysis of the treated water (permeate) for both the chemical and microbiological structure of the water. If the end requirement is not fully understood and correctly designed, it will be unsafe to treat dialysis patients and extremely costly to run,” says Donavan Hendricks, Director of Enaqua, a water purification and Reverse Osmosis specialist company based in Johannesburg.

“We have shown that correctly designed, efficient RO plants almost always, results in a visible cost saving on water, often cutting the customers water consumption and the costs thereof by up to 50% on a monthly basis compared to using a cheap off the shelf RO system”, Hendricks adds.

Validation of a dialysis system is essential for establishing the necessary water quality and ensuring the disinfection processes are sufficient to keep the microbial contaminants below the maximum allowable limits.

Whilst monitoring is only a small part of ensuring water quality in dialysis, it is immensely important. Often there is a shortage of skills and diligence in-house and the monitoring is neglected. Dialysis facilities need to have up-to-date logs that allow the technicians or supervisor to trend the chemical, bacterial, and plant performance data such as cross flow, pressure and conductivity.

A facility with the capacity to be proactive in disinfecting or conducting corrective measures when action levels have been reached, and certainly before the maximum contamination levels have been exceeded, will be at a distinct advantage. Regular maintenance of the machines, knowledge of factors that impact dialysis water, and pathways for corrective measures to be implemented and actioned rapidly, are key to effective and safe dialysis.

Keeping accurate logs of water quality surveillance data, with regard to chemicals and microorganisms, instils accountability among the dialysis technicians and allows for trends to be determined in Africa. It is essential to partner with knowledgeable companies that understand and can avoid the potential hazards that poor water quality can cause in dialysis.

The avoidance of complications arising from water contaminants, be it chemical or microbiologic, requires a constant and vigorous attention to water quality to ensure compliance. When the processes to provide sufficient product water of

appropriate quality for the facility are adequately stabilised, the facility will need to continually look at ways to improve the level of wasted water often experienced through RO treatment.

The patient population is increasing and as technology and the clinical science on renal replacement therapy improves, dialysis therapies will continue to be an evolving and increasing health treatment in Africa, hence, the continual need for water treatment processes that are effective and safe.

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