Excellent Water Quality Key to Safe Dialysis

Ensuring safe procedures in the dialysis unit is essential to the health and well-being of patients. The Practicing Nephrologists Advisory Group this month addresses water quality. Future issues of ASN Kidney News will look at other patient safety concerns.

By Andrew Fenves, on behalf of the ASN Practicing Nephrologists Advisory Group

Nephrologists in clinical practice take it for granted that when they arrive for morning rounds the hemodialysis machines will be set up and ready to go, with the water for the dialysate purified and inspected.

In fact, the level of water purity required to ensure patient safety has gradually evolved since hemodialysis was introduced many decades ago.

The case study below, from a large community-based teaching hospital, illustrates how water quality can change unexpectedly, and the importance of rapid response to such changes to ensure patient safety.

Case study

At this facility, hemodialysis nurses and dialysis technicians arrive at around 6 a.m. to set up the 10 stationary hemodialysis machines and inspect the two traveling machines for use in the intensive care unit.

The first sign of trouble was an elevated chloramine level in the deionized water. This water came from a central water source one floor above the acute hemodialysis unit. Chloramine levels were repeatedly 15- to 20-fold above the usual levels. All dialysis treatments were put on hold, and staff members contacted the bioengineering department. Soon, the dialysis care needs were diverted to the acute hemodialysis unit. Nurses that patients with emergent illness. In the meantime, bioengineering staff began inspecting the carbon filters as a first step to diagnose the problem. The medical director notified several nearby community dialysis centers and instructed the charge nurses that patients with emergent dialysis care needs should be diverted to nearby hospitals.

In the acute hemodialysis unit, all hemodialysis patients are exposed to very large quantities of water during a standard treatment. Failure to adequately treat water contaminated with chemicals, bacteria, or toxins, or failure to recognize that treatment components are not operating according to strict specifications, can put hemodialysis patients at risk of injury and even death.

Water treatment has evolved over the decades. By the late 1960s it was recognized that in addition to standard water purification systems, a deionizer was required to further purify the water (1). This eliminated the potential problem of methemoglobinema produced by the traces of copper in certain copper pipes used in some hospitals (1).

In 1973, investigators in Minnesota reported that methemoglobinema developed in several dialysis patients despite the use of reverse osmosis in purified urban water supplies (2). After some investigation, the authors identified chloramine as the culprit for the methemoglobinema in these patients (2, 3). Chloramine forms when water is treated with chlorine and ammonia, a common treatment technique in municipal water supplies. Chloramine can be removed by charcoal filtration. Hence, modern water treatment facilities now include charcoal filters along with a deionizer.

Even with this addition, sporadic cases are reported of methemoglobinema and hemolysis in some hemodialysis patients, caused by chloramine. These cases may reflect the use of a single carbon filter with insufficient capacity, or at times excessive water flow rates that allow insufficient contact with the carbon particles (4).

The case reported here illustrates how water supply and water quality may suddenly change without prior notification to hospitals or dialysis units. Accordingly, several safety precautions should be in place. First, careful and constant monitoring of water quality is essential. In this case, such vigilance prevented the potential adverse clinical events that would have otherwise occurred in the hospital.

Second, it is desirable to have an action plan in place in case the acute hemodialysis unit needs to close temporarily due to similar circumstances. Action plans will clearly differ depending on the particular circumstances of the hospital or outpatient clinic in question, but they should identify key individuals who can implement the actions necessary to assure maximal patient safety.

Here are some key points to remember about water quality and patient safety:

- Excellent water quality remains a key ingredient for delivering safe hemodialysis to our patients.
- Constant and careful monitoring of the water quality is essential.
- Contingency plans for a sudden change in water quality are important to maintain patient safety.
- The use of chloramines in water treatment facilities may pose an unexpected risk to water quality in certain circumstances.

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References