Air is Death to a Dialyzer

The hollow-fiber dialyzer is designed to remove toxins from the blood. This process involves removing toxins across the dialyzer’s semipermeable membrane. The main mechanism of toxin removal is diffusion through this membrane from an area of higher concentration to an area of lower concentration. The rate of diffusion, called the mass transfer rate, is determined by the concentration gradient across the membrane, membrane permeability, blood and dialysate flow rates, flow geometry, and the effective membrane surface area of the hollow-fiber dialyzer. One factor that staff has a dramatic influence over is maintaining the effective membrane surface area of the dialyzer.

Proper heparinization, proper priming, and rinsing are key elements for maximizing the effective surface area of a dialyzer, whether it is to be reprocessed or discarded after every use. The greater the surface area, the more toxins will pass through the membrane in any given time period. Air introduced into the dialyzer fibers and/or not adequately rinsed out can airlock individual fibers, preventing blood flow through the fibers (Figure 1). Air can also fracture into micro-bubbles that airlock pores in the membrane itself (Figure 2). This trapped air will not allow toxins and other solutes to diffuse across the semipermeable membrane.

How to minimize air introduction into the dialyzer fibers:

- Prime the saline administration line before priming the arterial blood line to eliminate the possibility of introducing air into the dialyzer.
- Prime the arterial line completely before attaching it to the dialyzer.
- Always prime the bloodlines and blood compartment of the dialyzer before connecting the dialysate hoses. The bicarbonate component of the dialysate will react with the Renalin® 100 Cold Sterilant solution in the blood compartment to produce gas bubbles that can block the fibers.

...in this issue
- Air is Death to a Dialyzer
- Editorial – The Ethics of Medical Waste
- 2008 Calendar of Events

continued on page 2
Air is Death to a Dialyzer

- Prime the dialyzer at a low blood pump speed in order to evenly purge the air from the fibers.
- Make sure the heparin line is primed. The heparin line is usually located after the drip bulb, and any air in the line will go directly into the dialyzer fibers.
- Ensure that the dialyzer is vertical; this prevents uneven filling of the dialyzer fibers. If the dialyzer is not kept vertical, air bubbles can accumulate in the arterial header and no blood will flow through the section of fibers directly below the accumulated air.
- Adjust the fluid level of both drip bulbs to 2/3 full. Drip bulbs that are too low allow air to be pulled into the lines and the dialyzer as the blood pump rate is increased.
- Use the palm of the hand, rather than a clamp or instrument, to gently tap the dialyzer to aid in air removal during priming. Sharp tapping with instruments has the potential of shattering large air bubbles into micro-bubbles that are more difficult to remove and can occlude the fibers. Hitting the dialyzer with hard objects can cause blood leaks and crack the dialyzer casing.

Q&A

The Handbook of Dialysis, Fourth Edition, states that “…there is less risk (theoretically) of clotting when a lower blood flow rate is used with a smaller dialyzer, as the blood velocity through a smaller fiber-bundle will be higher.”

To help increase the SFV and avoid hemocoagulation in the fibers and possible clotting, higher blood flow rates may be warranted when using a larger dialyzer.

Improper priming can lead to air being introduced into the hollow fibers of the dialyzer. Inadequate rinsing can lead to inadequate removal of air that is in the fibers. Air in the extracorporeal circuit predisposes the dialyzer to clotting. Air in the fibers limits the dialyzing surface area.

AIR IS DEATH TO A DIALYZER!

Reprocessing

Q: How do you disinfect the exterior of the dialyzer after you have capped and removed it from the Renatron® station?

A: AAMI RD 47:2002 Section 11.4.2 states “The outside of the dialyzer should be soaked or wiped clean of visible blood and other foreign material. For chemically disinfected dialyzers, a low-level germicide that is compatible with the dialyzer’s materials of construction should be used for this purpose.”

The rationale for Section 11.4.2 in Annex A of RD 47 further states, “Low-level germicides satisfactorily clean the exterior of the device, comparable to the degree of cleaning that a new dialyzer receives.”

The instruction manual for the Renatron® II 100 Series Dialyzer Reprocessing System suggests: “Wipe the entire capped, reprocessed dialyzer with a disposable wipe soaked in fresh 1% Renalin® 100 solution or full strength Actril Cold Sterilant or place the entire dialyzer in a container of 1% Renalin 100 solution or full strength Actril Cold Sterilant.” If other methods, such as using a spray bottle, are used ensure the disinfectant contacts all exterior surfaces of the dialyzer.

Example of Single-fiber Velocity (SFV) at different BFR

<table>
<thead>
<tr>
<th>Model</th>
<th>Surface area (m²)</th>
<th>Fiber bundle (Number of fibers)</th>
<th>SFV (in cm/sec) at BFR of 300 ml/min</th>
<th>SFV (in cm/sec) at BFR of 400 ml/min</th>
</tr>
</thead>
<tbody>
<tr>
<td>Primus® 1350</td>
<td>1.39</td>
<td>1350</td>
<td>1.64 cm/sec</td>
<td>2.18 cm/sec</td>
</tr>
<tr>
<td>Primus® 2000</td>
<td>2.0</td>
<td>2000</td>
<td>1.14 cm/sec</td>
<td>1.58 cm/sec</td>
</tr>
</tbody>
</table>
The Ethics of Medical Waste

A guiding principle of healthcare is, “First, Do no harm.”

This is usually directed at the healthcare professional who takes care of the individual patient. While the primary focus of medicine should be on the patient, more and more eyes within an organization are looking at how healthcare affects the community at large. How do the individual actions taken in caring for a patient affect all of us? One area of increasing concern is the staggering amount of disposable products used in providing healthcare, much of it oil-based; and the fact that this amount is increasing each year.

The manufacturing, distribution, and disposal of all these oil-based products is not done in a vacuum; each process consumes energy and effects the environment.

Not only should we “Do no harm,” we should also follow the adage of, “Do the right thing.”

As a prudent healthcare worker, consider the following questions:

• Does the generation and disposal of vast amounts of waste in the pursuit of healthcare contradict the medical credo of “Do no harm?”

• Are there safe alternatives to the traditional handling of medical waste?

• If there are alternatives that do not compromise patient safety and are economically viable, do you have a moral imperative to look at the use of these alternatives?

• Do safe and efficacious alternatives also allow you to “Do the Right Thing?”

While the reuse of devices labeled for single use may cause concern, the reprocessing and reuse of medical devices designed and labeled for multiple use should not be called into question. Hollow-fiber hemodialyzers have been designed, tested, and manufactured with multiple use in mind, and the reprocessing of these hemodialyzers has a proven track record that is decades long.

Very few reusable devices have come under as much regulatory and auditing scrutiny as the reprocessing of hemodialyzers. Not only has the reprocessing of hemodialyzers withstood years of regulation and scrutiny, but in my opinion, those years of regulation and scrutiny have made reprocessing even safer and better.

Reprocessing is more environmentally friendly than the practice of discarding dialyzers after one use. The reprocessing of multiple-use dialyzers decreases the amount of oil, a nonrenewable resource, consumed in dialyzer production and distribution. Reprocessing also dramatically reduces the number of dialyzers that are incinerated or end up in community landfills.

In addition, the byproducts of reprocessing are all natural, do not harm the environment, and degrade quickly into oxygen, water, and acetic acid.

Healthcare professionals have a responsibility and obligation to “Do the right thing.” This applies not only to the health of the individual patient, but also to the environmental health of the community. The reprocessing of dialyzers allows for the care of both; it is truly a win-win situation. Reprocessing not only promotes the concept of “Do no harm,” it allows the healthcare professional to “Do the right thing.”

Renalin® 100 Cold Sterilant, the sterilant used for dialyzer reprocessing, are all natural, do not harm the environment, and degrade quickly into oxygen, water, and acetic acid.

For first time, oil hits $100 a barrel

By James R. Healey, USA TODAY

The price of oil hit $100 a barrel in commodities trading Wednesday — the first time that’s happened — and ended the trading day not far below that chilling mark, at $99.62 a barrel.


An Editorial by Kendall Larson, Clinical Specialist

Jan. 4, 2008

KidneyTalk!™

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MinnTech®

Renal Support Systems
A Patient’s Guide to Dialyzer Reprocessing

The updated version of A Patient’s Guide to Dialyzer Reprocessing is available for downloading at http://www.minntech.com/renal/patient/index.html. This guide gives patients and their families valuable information on the history, safety, and economics of dialyzer reprocessing and takes a detailed look at the components that make up a successful dialyzer reprocessing program. The Patient’s Guide can assist the dialysis staff in explaining and educating patients to your dialyzer reprocessing program and help them become more active participants in their own dialysis therapy. The Patient’s Guide is in a PDF format which allows you to print copies as needed in English or Spanish.

Dialyzer Reprocessing System Service/Maintenance Seminar
RS-8300 Renatron®/RS-8330 Renatron® II

Each two-day seminar covers:

- Renatron specifications and operational procedures
- Renalin® description, specification, dilution, handling instructions and testing
- Calibration and maintenance lab
- Performing calibration and maintenance procedures
- Hydraulic schematic and program outlines
- Hands-on troubleshooting using hydraulic schematics
- Troubleshooting techniques and repair lab

DATES
May 13-14, 2008
May 15-16, 2008
July 15-16, 2008
July 17-18, 2008
November 11-12, 2008
November 13-14, 2008

LOCATIONS
Las Vegas, NV
Las Vegas, NV
Cleveland, OH
Cleveland, OH
Orlando, FL
Orlando, FL

Please contact Stephanie Frankhouser at 800-328-3345 Ext. 504 for more information.