ReNews®
A publication on dialyzer reprocessing
volume 13, 2008

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 air-lock pores in the membrane itself *(Figure 2)*. This trapped air will not allow toxins and other solutes to diffuse across the semi-permeable membrane.

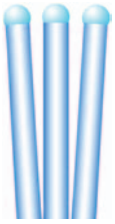


Figure 1

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.

continued on page 2

Q&A

BFR and SFV

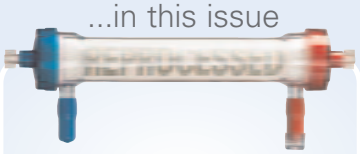
Q: What are the implications of the blood flow rate (BFR) on dialyzer performance?

A: The same BFR does not have the same effect on all dialyzers. The blood flow rate is not the only factor to take into account; the single-fiber velocity (SFV) should also be considered. Single-fiber velocity is the rate that blood flows through a single fiber of a dialyzer. To determine the single-fiber velocity of a given dialyzer, you need to know the inside diameter of the fibers, the length of the fibers, the number of fibers, and the blood flow rate. At any particular blood flow rate, the larger the fiber bundle, the lower the single-fiber velocity. A 30% increase in the number of fibers of a dialyzer is equal to a 30% decrease in the single-fiber velocity.

Hollow Fiber

continued on page 2

...in this issue



- **Air is Death to a Dialyzer**
- **Editorial – The Ethics of Medical Waste**
- **2008 Calendar of Events**

MINNTECH® renal systems

Air is Death to a Dialyzer continued from page 1

- 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.

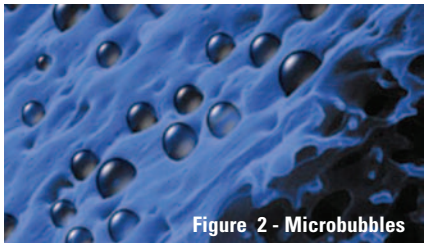


Figure 2 - Microbubbles

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!

Q&A

continued from page 1

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

[1] Daugirdas John T., Blake Peter G., Ing Todd S., Handbook of Dialysis, Fourth Edition, page 130

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

Model	Surface area (m^2)	Fiber bundle (Number of fibers)	SFV (in cm/sec) at BFR of 300 ml/min	SFV (in cm/sec) at BFR of 400 ml/min
Primus® 1350	1.39	1350	1.64 cm/sec	2.18 cm/sec
Primus® 2000	2.0	2000	1.14 cm/sec	1.58 cm/sec

The Ethics of Medical Waste

An Editorial by Kendall Larson, Clinical Specialist

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

Jan. 4, 2008

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.

Retrieved January 18, 2008, from http://www.usatoday.com/money/industries/energy/2008-01-02-crude-wed_N.htm

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.

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."*

MINNTECH® renal systems

Calendar of Events 2008

March

National Association of Nephrology Technicians/Technologists (NANT) 25th Annual Training Symposium
(www.nant.biz)
March 18-20, 2008
Las Vegas, NV

6th Winter World Transplant Games 2008
March 26-31, 2008
Rovaniemi, Finland

April

NKF 2008 Spring Clinical Nephrology Meetings
(www.kidney.org)
April 2-6, 2008
Dallas, TX

ANNA 39th National Symposium
(www.annanurse.org)
April 27-30, 2008
Philadelphia, PA

May, June, July

Annual NPSF Patient Safety Congress
(www.npsf.org)
May 14-16, 2008
Nashville, TN

XVII World Transplant Games
(www.kidney.org)
July 11-16, 2008
Pittsburgh, PA

August

National Kidney Awareness and Education Week (www.annanurse.org)
August 4-8, 2008

17th World Transplant Games
(www.worldtransplant games 09.com),
August 22, 2008
Gold Coast, Australia

September

Nephrology Nurses Week
(www.annanurse.org)
September 14-20, 2008

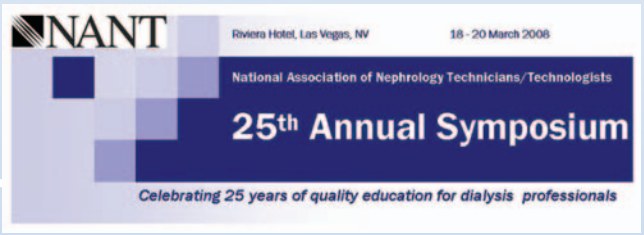
National Renal Administrators Association (NRAA) 31st Annual Fall Conference
(www.nraa.org)
September 24-26, 2008
Cleveland, OH

MeritCare - NBT Symposium
(www.meritcare.com)
September 17-18, 2008
Fargo, ND

October, November

CANNT Annual National Symposium
(www.cannt.ca)
October 23-26, 2008
Quebec City, Quebec

American Society of Nephrology (ASN) Renal Week 2008
(www.asn-online.org)
November 4-9, 2008
Philadelphia, PA



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	LOCATIONS
May 13-14, 2008	Las Vegas, NV
May 15-16, 2008	Las Vegas, NV
July 15-16, 2008	Cleveland, OH
July 17-18, 2008	Cleveland, OH
November 11-12, 2008	Orlando, FL
November 13-14, 2008	Orlando, FL

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

MINNTECH® renal systems
Minntech Corporation
14605 28th Avenue North
Minneapolis, Minnesota 55447-4822 USA
Telephone: (763) 553-3300
Fax: (763) 553-3387