

GLAUCOMA

Connecting the Dots Between Hemodialysis and IOP

BY MIRIAM KARMEL, CONTRIBUTING WRITER

Patients who have both glaucoma and kidney disease present a special challenge to the ophthalmologist. That challenge is to identify and manage those patients in whom dialysis raises intraocular pressures to the extent that glaucoma progression is exacerbated.

Ever since a relationship between IOP and dialysis was first noted, more than 40 years ago,¹ researchers have looked at everything from the method of measuring IOP to the influence of dialysis type, the range of IOP changes during dialysis, the time of measurements and even the duration of dialysis. Theories and conclusions have varied greatly.² Significant spikes as well as drops in pressures during dialysis have been reported, and, curiously, some studies have found that dialysis had no effect on IOP whatsoever.

Despite a dearth of consistent data, experts stress the need for ophthalmologists to understand the destructive potential of uremia and dialysis, at least in a subset of glaucoma patients. While not too common, “There is a relevant subgroup of patients who may be progressing in their glaucoma,” for no apparent reason, said Paul J. Lama, MD. “It may be because they’re spiking during dialysis.” Dr. Lama is director of the Glaucoma Institute of Northern New Jersey and associate clinical professor of ophthalmology at Columbia University.

“The fact that the pressure can change significantly with hemodialy-

sis probably should be more widely known than it is right now,” Sanjay G. Asrani, MD, said. “We need to be aware of this. This is a phenomenon that’s happening to some of our glaucoma patients. They’re getting worse during dialysis.” Dr. Asrani is associate professor of ophthalmology at Duke University.

Why the IOP Irregularities?

The somewhat perplexing variation in reported IOP depends upon the net effect of several key factors, said Dr. Lama. These include aqueous outflow facility, individual aqueous humor dynamics and the dialysis prescription. “These variables may interact to raise, lower or have no effect on IOP,” he said.

The most widely proposed mechanism for IOP rise during dialysis centers on a reduction in colloid osmotic pressure or total serum osmolarity in the patient’s vascular system. Although most aqueous is produced by active transport mechanisms, the ultrafiltration component of aqueous production can be significant. It is this component that is affected by dialysis, Dr. Lama said. During the dialytic process, solutes—urea toxins in particular—are removed from the blood, and the osmolarity of the blood is reduced. This reduction in plasma or serum osmolarity favors net water movement in the direction of aqueous production. As the osmolar gradient intensifies, water flows into the aqueous fluid compartment and IOP rises.

Urea Out, Pressure Up?



A venous bubble trap on a hemodialysis monitor.

Who is at risk? Patients who don’t have glaucoma, or those who do but are well-controlled with medication or filtering surgery, can accommodate the fluid buildup, said Dr. Asrani. But an eye with a compromised outflow system cannot. “When the fluid shifts, you get increased fluid overflow in the eye that overwhelms the outflow system,” he said. This causes the pressure to rise.

At risk, said Dr. Asrani, is a small subset of glaucoma patients who, due to significant outflow obstruction, cannot handle the disequilibrium that arises during dialysis:

- patients with narrow angles,

Pearls From a Kidney Doc & Three Eye Experts

Dr. Anthony Lama: “The ophthalmologist has to tell me the patient is not compensated, that the pressures are high or they’re having an acute glaucoma attack.”

Dr. Paul Lama: “If the patient is on hemodialysis and has glaucoma or occludable angles, iridotomy should be performed expeditiously. If the patient is already on dialysis, the nephrologist should be alerted. The patient’s dialysis prescription may be tailored to minimize the risk of a clinically significant IOP spike.”

Dr. Jaime Levy: “The medical team treating the dialysis patient should be alert to possible ocular symptoms of acute IOP rise, such as blurred vision, eye pain, headache or signs like mid-dilated pupil or corneal edema. And they should consult the ophthalmologist in case of suspected IOP rise.”

Dr. Sanjay Asrani: “Some of our glaucoma patients are getting worse during dialysis. At least in those patients, make sure their visual fields are not getting worse. And ask about symptoms of pressure spikes during dialysis, such as headaches and blurry vision. That can clue you in that they’re having spikes in IOP.”

- those with very advanced glaucomatous damage or
- those with obstructed outflow due to neovascular glaucoma.

“Patients who experience high IOP during hemodialysis can experience insults or injuries to the optic nerve due to these spikes,” Dr. Asrani said.

He added that many dialysis patients also have diabetes, a disease that causes lenses to be intumescent. “They’re the group prone to narrow angles,” he said.

Slow aqueous + dialysis = ↑ IOP.

Jaime Levy, MD, agreed. “In patients with glaucoma or with a predisposition toward narrow angles, or in eyes with impaired aqueous outflow, the possibility of an acute rise in IOP during hemodialysis can be much more frequent than in normal patients,” he said. Dr. Levy is senior ophthalmologist and ophthalmic pathologist at Soroka University in Beer-Sheva, Israel.

Signs that pressure may have spiked during hemodialysis include complaints of headache, orbital pain and blurry vision at the time of dialysis, Dr. Asrani said. “That can clue you in that they’re having rises in IOP.” Another clue is hemorrhage in the optic disc, he added. “That’s a red flag telling us the pressure has not been controlled.”

How to Manage

There’s no clear consensus on how to treat these patients, said Dr. Levy, who

was part of a team of ophthalmologists and nephrologists that conducted a review of the dialysis/IOP literature.² “I would recommend checking IOP in every glaucomatous patient before, during and after the dialysis, at least during three consecutive weeks,” he said. If there are IOP fluctuations greater than 10 mmHg, Dr. Levy would recommend eye examinations and visual field/OCT perhaps every four to six months. Patients with advanced glaucoma should be examined more closely, he said.

Capture the patient during dialysis. While Dr. Asrani also recommended following dialysis patients with very advanced glaucoma more

closely, he said that getting them back in the eye clinic can be a challenge, given their three-times-weekly dialysis schedule. These patients often “can’t be compliant with their visits because of their systemic health.” Dr. Levy suggested that in these noncompliant cases, another doctor should measure IOP at the dialysis clinic with a hand-held tonometer.

Preemptive measures. Dr. Asrani favors a prophylactic approach. “In a patient with a narrow angle, even if they’re borderline, I recommend laser iridotomy prior to dialysis,” he said. And if the angle is narrow due to a cataract, he recommends cataract removal. “I would do these procedures as soon as I could,” he said. Dr. Asrani added that for patients in whom he detects an optic disc hemorrhage, he will do a visual field test in about six months. “If you find them progressing in terms of visual field, they would need an outflow procedure, like a tube or trabeculectomy,” he said.

Work With the Kidney Doc

The patient’s nephrologist can play a big role in managing the pressure spikes in glaucomatous patients. There are a number of measures reported in the literature that are available to nephrologists to control intraocular pressure during dialysis, Dr. Levy said, including:

- initiating intravenous mannitol,

Caution With Carbonic Anhydrase Inhibitors

Oral CAIs could be fatal to patients with end-stage renal disease, said Dr. Levy. While acetazolamide therapy, for example, can prevent IOP rise, Dr. Levy warned against using it in patients on dialysis, “owing to metabolic acidosis probably by interfering with extrarenal buffering systems.”¹

Dr. Asrani agreed. “If patients are on dialysis or have renal failure, I would be very hesitant using a drug like acetazolamide because of metabolic acidosis.”

But Dr. Anthony Lama noted that if a patient with end-stage renal disease needs urgent IOP lowering and is not a candidate for immediate surgical intervention, oral CAIs may be used, with caution. The danger is of improper dosing leading to extremely high plasma levels and worsening metabolic acidosis, especially with acetazolamide, which can only be excreted by the kidney, he said. As a short-term measure, a loading dose of 250 mg may be given, followed by 125 mg QD for four days. “If longer therapy is necessary, plasma levels should be checked,” he said.

1 Levy, J. et al. *Eye* 2005;19:1249–1256.

- adding bicarbonate to the dialysate,
- considering peritoneal hypertonic sodium dialysis,
- changing the dialysis parameters by creating conductivity and ultrafiltration profiles and adding a colloid solution at the beginning of the procedure and
- slowing urea removal.

Dr. Levy added that his research group has prevented IOP rise in two glaucomatous patients by slower urea removal and longer dialysis.

Eye doctor to kidney doctor—can you hear me now? Dr. Lama stressed the importance of open communication between ophthalmologist and nephrologist, especially when working with patients with advanced glaucoma or those with a tenuous disease status. “The nephrologist can then tailor the patient’s dialysis prescription to minimize risk of a clinically significant IOP spike,” he said.

Knowing a patient’s ocular state does make a difference, said Dr. Lama’s brother, Anthony J. Lama, MD, who is assistant clinical professor of nephrology at Tulane University. He always checks IOP and carefully monitors his patients’ eyes. “I ask every patient whether they have glaucoma. This is routine for me. If I screen them, I know if they’re having an acute glaucomatous attack, and I can do certain things,” said Dr. Lama. “I have many patients with glaucoma who are on dialysis and have never seen a problem.”

Or as Dr. Paul Lama put it, the take-home message is remembering to connect the dots. “As ophthalmologists, we should have an idea of how other disease states and treatment of other disease states can potentially impact the health of the eye.”

1 Sitprija, V. et al. *Invest Ophthalmol Vis Sci* 1964;3:273–283.



2 Levy, J. et al. *Eye* 2005;19:1249–1256.

Dr. Asrani is on the speakers’ bureau for Alcon, Merck and Pfizer. Dr. Anthony Lama reports no related interests. Dr. Paul Lama is on the speakers’ bureau for Alcon, Allergan, Merck and Pfizer. Dr. Levy reports no related financial interests.

Everything You Need . . .



. . . all in one place.

	Perspectives on medical management		Strategies for surgical success
	Summaries from the major eye journals		Advice from the Savvy Coder
			News from the Academy

EyeNet Magazine



The one source to keep you current on your profession.

Watch your mailbox for the print version or visit online at www.eyenetmagazine.org.

Comments: E-mail EyeNet at eyenet@aao.org

Advertise: Contact M.J. Mrvica Associates at 856-768-9360 or mjmrvica@mrvica.com.

