Researchers Look to Solar Power to Make Dialysis Greener

By Tracy Hampton

Solar power can help offset the high utility costs of hemodialysis, making the treatments more environmentally friendly, report scientists in Australia. The findings, published recently in the Clinical Journal of the American Society of Nephrology, point the way to a “green dialysis” future when resources are used and reused wisely.

Hemodialysis treatments for kidney failure patients require a considerable amount of basic utilities such as water and power, leaving a vast carbon footprint behind that is sure to grow as the incidence and prevalence of dialysis use inevitably rise worldwide. “As our planet’s population continues to grow, so does the sustainable growth rate of the dialysis patient population. This annual growth rate is now expected to be 6 percent, which will give us roughly 4 million patients by 2025,” said Faissal Tarrass, MD, head of the department of hemodialysis at the Hospital Princessa Lala Meriem, in Morocco.

Demands of dialysis

Research indicates that each hemodialysis treatment uses more than one half the daily power consumption of an average Australian four-person home, and power prices are predicted to soar to two to three times the current rate over the coming decade in Australia. Yet little thought has yet been given to addressing the resource demands of dialysis.

To see whether solar energy might be used to help meet the power demands of dialysis equipment, John Agar, MBBS, Anthony Perkins, and Alwie Tjipto, MBBS, of Geelong Hospital, Barwon Health, in Victoria, Australia, established a solar-assisted dialysis program in Geelong (located in southeastern Australia) that included four home dialysis machines. For solar comparison, Geelong is comparable with St. Louis, Missouri.

Previously, the investigators conducted other resource conservation initiatives that addressed water reuse practices and recycling of reject water. They successfully developed interventions that have reduced water losses of up to 100,000 L per week across their facility and home hemodialysis sites. For example, reject water from the hospital-based dialysis unit provides

No Reduction from Paracalcitol on Left Ventricular Mass in CKD Patients, but Other Outcomes Hint at Benefit

Forty-eight weeks of paracalcitol, the active hormonal form of vitamin D, doesn’t reduce left ventricular mass or most measures of cardiac function in patients with stage 3 or 4 chronic kidney disease (CKD), according to a study published in the Feb. 15 Journal of the American Medical Association. But there was one intriguing finding: treatment reduced left atrial volume and improved some clinical outcomes, setting the stage for larger studies to explore whether treatment with paracalcitol has a role in treatment of CKD patients.

“Cardiac hypertrophy is exceedingly common in patients with chronic kidney disease, both before and on dialysis,” according to Ravi Thadhani, MD, lead investigator and director for clinical research in nephrology at the Massachusetts General Hospital in Boston. CKD patients are “profoundly deficient” in vitamin D, and observational studies and animal models have suggested that vitamin D might reduce left ventricular hypertrophy. It was that hypothesis that Thadhani and colleagues set out to test.

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autoclave steam for instrument sterilization, ward toilet flushing, janitor stations, and garden maintenance. Satellite center reject water is tanker-trucked to community sporting fields, schools, and gardens. Home-based nocturnal dialysis patient reuse reject water is used for home domestic utilities, gardens, and animals. A natural progression for the team was to move from water to power.

The group chose solar power above wind power for this study because solar radiation is silent and, because it penetrates clouds, more dependable. Wind is unpredictable, and harnessing its power can cause noise and visual pollution. This study represents the first known and reported solar project in dialysis.

For their study, the investigators used the simplest solar model: array donation to, and service draw from, the national grid. The power generated by the solar array was metered and recorded before being directed to the national grid, permitting weekly tracking of all grid-donated power and power drawn specifically for dialysis-related use.

Cutting costs, saving resources
After the first 12 months of the program (from July 26, 2010, to July 25, 2011), power costs were reduced by 76.5 percent. Interestingly, the authors report that from a “what has the weather been like” assessment of Geelong, the 12-month study period was one of the worst remembered; however, solar exposure is not entirely dependent on sunshine and sunlight.

Thadhani
In the coming years, the system is expected to turn a profit in addition to generating effectively free power. A solar array is estimated to have a lifespan of approximately 30 years.

“Geelong Hospital is showing that renewable power for dialysis is both practi- cial and cost-effective,” said Frances Mortimer, MRCP, who was not involved with the research and is the medical director of the Centre for Sustainable Healthcare in Oxford, UK.

“Professor Agar’s article provides a timely reminder of the environmental impacts of health care, in particular, cardiovascular disease. We have many opportunities to improve our renal medicine in particular,” said Andrew Connor, MD, who was the Centre for Sustainable Healthcare’s first Green Nephrology Fellow (2009–2010). “It’s inspiring to see practical measures being put into place to reduce these impacts and to realize financial benefits simultaneous- ly.” Connor, who is in the department of renal medicine at Derriford Hospital, in Plymouth, UK, has published widely in the field of sustainable health care.

Directors of dialysis services may wish to investigate whether they can take simi- lar steps toward greener dialysis, taking into account that charges for grid-provided power and reimbursement rates vary from water to power. Perhaps most intriguingly, there was a significant reduction in left atrial volume in patients receiving paracalcitol compared to placebo-treated patients (p < 0.003), with the change occurring gradually and steadily over the 48 weeks. This outcome measure was not prespecified but instead was exploratory. Thadhani noted, “so we have to be cautious. But all together, the hospitalizations, the BNP, and the left atrial volume begin to define a treatment signal pointing to diastolic function.” The change in atrial volume was not accompanied by any changes in blood pressure.

“What we think is happening is that the drug is allowing better relaxation during diastole, therefore allowing the heart to have a stronger squeeze. The heart’s ability to relax is better, and as a result its ability to pump is better. The signal is a functional, rather than structural, change,” he said.

Thadhani cautioned that therapy with paracalcitol was associated with more episodes of elevated calcium, and that paracalcitol, like other agents that activate the vitamin D receptor, can elevate serum creatinine without changing glomerular filtration rate. “Clinicians need to be aware of these two consequences of the therapy,” he said.

Conner has worked to spread this same message in recent years by leading work to determine the carbon footprints of renal services and different dialysis regimens. In the UK, his work within the Green Nephrology Programme has included recruiting a network of Green Nephrology Local Representatives in over half of the nations’ kidney units, surveying the environmental practices of these units, and developing tools to reduce their impacts through case studies.

“One of the challenges for the future must now be to drive down the emissions generated in the production of dialysis consumables,” Conner said.

Protecting the environment is a worthy cause in itself, but there may be additional motivation to green nephrology because patients with kidney disease are particularly vulnerable to the effects of climate change. For example, extremes of weather can disrupt dialysis services and negatively affect the health of these patients, who are particularly at risk in very hot weather.

Disclosure: Fresenius Medical Care (Australia) provided the funding and secured the technical advice to resource the project.


Paracalcitol
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in the study. He chose to use paracalcitol, rather than the dietary form of vitamin D, because the conversion to the hormo- nal form takes place in the kidneys, and is impaired in CKD.

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