CANNT JOURNAL
JOURNAL ACITN

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IN THIS ISSUE:

FOR THE TREATMENT OF ANEMIA DUE TO CHRONIC KIDNEY DISEASE (CKD)

Aranesp® dose at conversion from Eprex® is numerically less*

The relationship between baseline epoetin and maintenance Aranesp® is non-linear across the dosing spectrum.†

For example, if previous epoetin alfa dose (IU/week) is 11,000 to 17,999 IU, estimated Aranesp® starting dose (µg/week) should be 40 µg (275-450:1 conversion ratio).

Recommended conversion doses

Estimated Aranesp® starting dose (µg/week) based on previous epoetin alfa dose (IU/week) for CKD patients as recommended in the Product Monograph†

Previous Weekly Epoetin Alfa Dose (IU/week)	Weekly Aranesp® Dose (µg/week)	Conversion Ratio
<2,500	6.25	≤400
2,500 to 4,999	12.5	200 to 400
5,000 to 10,999	25	200 to 440
11,000 to 17,999	40	275 to 450
18,000 to 33,999	60	300 to 567
34,000 to 89,999	100	340 to 900
≥90,000	200	≥450

Adapted from Product Monograph.†
Please see the Aranesp® Product Monograph for complete dosing recommendations.

IMPORTANT SAFETY INFORMATION

Indication and clinical use:

For the treatment of anemia associated with chronic kidney disease (CKD), including patients on dialysis and patients not on dialysis.

Aranesp® is not intended for patients who require immediate correction of severe anemia or emergency transfusions.

Blood pressure should be adequately controlled prior to initiation of Aranesp® therapy and must be closely monitored and controlled during treatment.

Aranesp® is not indicated for other causes of anemia such as iron or folate deficiencies, hemolysis, or gastrointestinal bleeding, which should be managed appropriately.

Contraindications:

Aranesp® is contraindicated in patients:

- with uncontrolled hypertension
- who develop Pure Red Cell Aplasia (PRCA) following treatment with any erythropoiesis-stimulating agents (ESAs)
- with known hypersensitivity to the active substance or any of the excipients
- with sensitivity to mammalian cell-derived products
- with sensitivity to albumin (where applicable with the albumin formulation. Note: the albumin formulation is not currently available in Canada)

Most serious warnings and precautions:

Increased mortality, serious adverse cardiovascular reactions, thromboembolic events and stroke: To minimize risk of death, serious adverse cardiovascular reactions and stroke, follow the recommended dosage for each indication for Aranesp® and other ESAs. Increased incidence of thromboembolic events has been observed in patients treated with erythropoietic agents. Increased incidence of deep vein thrombosis (DVT) in patients receiving ESAs and undergoing surgical orthopedic procedures has been observed. Increased mortality was observed in patients receiving ESAs who were undergoing coronary artery bypass surgery. Aranesp® is not authorized for reduction in allogenic RBC transfusions in patients scheduled for surgical procedures.

- *Patients with Chronic Kidney Disease:* In controlled trials, patients experienced greater risk of death, serious adverse cardiovascular reactions and stroke when they were administered ESAs to target hemoglobin levels of 130 g/L and above. Individualize dosing to achieve and maintain hemoglobin levels within the range of 100 g/L to 115 g/L, not to exceed 120 g/L. Patients with CKD and an insufficient hemoglobin response to ESA therapy may be at even greater risk for adverse cardiovascular reactions and mortality than other patients. A rate of hemoglobin rise of >10 g/L over 2 weeks may contribute to these risks.

Hypertension: Patients with uncontrolled hypertension should not be treated with Aranesp®; blood pressure should be adequately controlled before initiation of therapy with Aranesp®. Hypertensive encephalopathy and seizures have been observed in patients with CKD.

Seizure: Aranesp® should be used with caution in patients with a history of seizures. During the first several months of therapy, blood pressure and the presence of premonitory neurologic symptoms should be monitored closely, and patients should be cautioned to avoid potentially hazardous activities such as driving heavy machinery during this period.

Pure Red Cell Aplasia (PRCA): Antibody-mediated PRCA has been reported after months to years of treatment with ESAs. Cases of severe anemia, with or without other cytopenias, associated with neutralizing antibodies have also been reported in patients treated with Aranesp®.

Other relevant warnings and precautions:

- Patients with underlying hematologic diseases
- Serious allergic reactions
- Lack or loss of response to Aranesp®
- Patients with CKD not requiring dialysis
- Patients on dialysis
- Monitoring and laboratory tests such as hemoglobin and iron status
- In pregnancy and in nursing women
- Pediatric and geriatric populations

For more information:

Please consult the Product Monograph at http://www.amgen.ca/Aranesp_PM.pdf for information about adverse reactions, interactions and dosing (particularly regarding the administration of Aranesp® under the supervision of a healthcare professional, the longer serum half-life of Aranesp®, and the dosing and monitoring information when changing the route of administration) which have not been discussed in this piece. The Product Monograph is also available by calling Amgen Canada Inc. at: 1-866-502-6436.

* Comparative clinical significance is unknown.
† Due to the longer serum half-life, Aranesp® should be administered less frequently than epoetin alfa. The same route of administration should be used at conversion.

Reference: 1. Aranesp (darbepoetin alfa) Product Monograph. Amgen Canada Inc. October 9, 2015.

SC · IV
Aranesp®
(darbepoetin alfa)

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CANNT JOURNAL
JOURNAL ACITN

CANNT ACITN
CANADIAN ASSOCIATION OF NEPHROLOGY NURSES AND TECHNOLOGISTS
L'ASSOCIATION CANADIENNE DES INFIRMIÈRES ET TECHNICIENS DE NÉPHROLOGIE

CONTENTS

IN EACH ISSUE:

The CANNT Journal is printed on recycled paper.

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The CANNT Journal is produced by Pappin Communications, The Victoria Centre, 84 Isabella St., Unit 2, Pembroke, Ontario K8A 5S5

Letter from the Editors

Welcome all to the first *CANNT Journal* issue of 2016! We are honoured to continue to provide you, our members, with a high-quality journal where we can share and disseminate some truly fantastic work being done in nephrology circles across Canada. Our goal is to continue to provide you with useful and interesting information to advance your practice.

In this issue, we are leading off with an article related to the transplant referral process. In the Tech Talk column, we explore some of the fundamentals of dialysis related to water treatment, which we hope will help to foster an appreciation for the complexities related to providing safe water for hemodialysis. In the Continuing Education Series, we take a deeper look at phosphate binders. In the Practice Corner column, we explore further ultrasound-guided cannulation with the aid of a simulation model (phantom). In the Psychonephrology column, we explore fatigue in Chronic Kidney Disease (CKD). We are also pleased to present the second article in the series on conservative renal care by Betty Ann Wasylynuk and Dr. Sara Davison. We hope the articles and columns will help you develop a deeper knowledge related to your practice.

As always, we accept and encourage submissions from seasoned and budding health care professionals in nephrology, as well as letters to the editor. We accept submissions related to original research, case studies, quality improvements, innovations in practice, and issues related to professionals in nephrology. Guidelines for submission are found on the CANNT website, and we accept submissions on an ongoing basis. Have an idea for publication? Get in touch with us!

Of course, publication is only one of many ways that you can contribute to advancing nephrology practice in Canada. We strongly encourage the nephrology community at large to consider presenting their work through other platforms, including organizational quality forums, regional conferences and, of course, annually at the national CANNT conference. Together, we can advance excellence in nephrology practice!

Matt and Jovina
CANNT Journal Co-editors

PLEASE SEND ALL SUBMISSIONS, QUESTIONS OR COMMENTS TO:

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Co-Editors, CANNT Journal:
Jovina Bachynski: **CANNT.journal1@gmail.com**
Matt Phillips: **CANNT.journal2@gmail.com**

Mot des corédacteurs en chef

Bienvenue au premier numéro du *Journal de l'ACITN* pour l'année 2016! Nous sommes ravis de continuer à offrir à nos membres un journal de grande qualité dans lequel nous pouvons partager et diffuser le travail vraiment exceptionnel qui est accompli dans les cercles de néphrologie partout au Canada. Notre objectif est de continuer à vous offrir de l'information utile et intéressante pour faire progresser votre pratique.

Dans ce numéro, nous vous présentons tout d'abord un article sur le processus d'orientation vers une transplantation. Dans la rubrique *Tech Talk* (Parlons technologie), nous examinons certains éléments fondamentaux de la dialyse en lien avec le traitement de l'eau qui, nous l'espérons, vous aideront à mieux comprendre à quel point il est complexe de fournir de l'eau sécuritaire pour l'hémodialyse. Dans la section *Continuing Education Series* (Série sur l'éducation continue), nous jetons un regard approfondi sur les chélateurs de phosphore. Dans la rubrique *Practice Corner* (Place à la pratique), nous examinons plus en détail la canulation échoguidée à l'aide d'un modèle de simulation (fantôme). La rubrique *Psychonephrology* (Psychonéphrologie) traite quant à elle de la fatigue en présence d'une maladie rénale chronique. Nous sommes aussi heureux de présenter le deuxième article de la série sur le traitement rénal conservateur, rédigé par Betty Ann Waslynuk et la D^re^ Sara Davison. Nous espérons que ces articles et rubriques vous permettront d'acquérir des connaissances plus approfondies qui vous aideront dans votre pratique.

Comme toujours, nous encourageons les professionnels de la santé débutants ou expérimentés en néphrologie à nous soumettre des articles, ainsi que des lettres à la rédaction. Nous acceptons les soumissions d'articles portant sur des recherches originales, des études de cas, l'amélioration de la qualité, l'innovation dans la pratique et les enjeux touchant les professionnels en néphrologie. Les directives à suivre pour soumettre un article se trouvent sur le site Web de l'ACITN, et nous acceptons les soumissions en tout temps. Vous avez une idée d'article qui pourrait être publié? Communiquez avec nous!

Bien entendu, publier un article n'est qu'une des façons de contribuer à l'avancement de la pratique en néphrologie au Canada. Nous encourageons fortement tous les membres de la communauté en néphrologie à présenter leur travail par l'intermédiaire d'autres plateformes, notamment des forums sur la qualité organisationnelle, des conférences régionales, et bien sûr, lors de la conférence annuelle nationale de l'ACITN. Ensemble, nous pouvons faire progresser l'excellence de la pratique en néphrologie!

Matt et Jovina
Corédacteurs du Journal de l'ACITN

Le Journal ACITN est la publication officielle de l'Association canadienne des infirmiers/infirmières et technologues en néphrologie, a/s P.O. Box 10, 59 Millmanor Place, Delaware, ON N0L 1E0, téléphone : (519) 652-6767, télécopieur : (519) 652-5015, Courriel : cannt@cannt.ca. Publié quatre fois par année, ce journal est envoyé à tous les membres de l'Association. L'abonnement annuel est: Canada, 80 $ (+TVH), E.-U., 90 $, hors du Canada et E.-U., 115 $. Les publications antérieures, lorsque disponibles, coûtent 7,50 $ (+TVH) chacune. Les opinions émises par les auteurs dans ce journal ne sont pas nécessairement partagées par l'Association ni par le corédactrices en chef. Nous invitons les lecteurs à nous faire part de leurs opinions. Toute correspondance devra être envoyée à l'ACITN, P.O. Box 10, 59 Millmanor Place, Delaware, ON N0L 1E0.

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Pembroke, Ontario K8A 5S5.

Our CANNT VPs, in collaboration with their regional colleagues, have reported some very exciting activities and accomplishments across the country. Some of the highlights include:

- Rick Luscombe, Vascular Access Clinical Nurse Leader at Providence Health Care in Vancouver, BC, was the recipient of the prestigious 2015 Wilma Crockett Award from the BC Renal Agency. The award is an opportunity for the BC renal and kidney transplant community to recognize those individuals who have made an outstanding contribution to patient care in the province. Rick, who co-founded the Vascular Educators Group of BC, was also the 2010 CANNT President and most recently the co-chair of the 2015 CANNT Annual Symposium in Vancouver.
- This past December, the Manitoba Centre for Health Policy released a report titled *"Care of Manitobans Living with Chronic Kidney Disease"*, outlining the state of kidney disease in Manitoba and the projected growth of dialysis patient populations. The report, co-authored by Dr. P. Komenda and Dr. N. Tangri, recommends strategies to manage the dialysis patient populations, including increasing the use of home dialysis.
- The Kidney Health Strategic Clinical Network, composed of passionate and knowledgeable health care providers from across Alberta, was launched on January 8, 2016. The network, created to improve care and outcomes of patients with kidney disease, plans to find new and innovative ways of delivering better quality, better outcomes, and better value.
- The REINQ (Regroupement visant l'excellence de la pratique infirmière en néphrologie au Québec) had its annual event in October 2015, which was very well attended by nurses from Quebec. Some of the topics presented included a review of the deontology of nursing practice, end-of-life decision-making and care, the decision to stop treatment, and diabetic foot and diabetic ulcer management. The REINQ will be organizing a day out for managers early in 2016 and a vascular access day is planned for spring 2016.
- Physician-assisted suicide has been a major topic for discussion in all realms of health care within Quebec. The Ministry of Health is once again looking at the organization of renal replacement therapies. The CHUM (Centre hospitalier de l'Université de Montréal) will be moving into its new premises in 2016 and is in the process of re-organizing the delivery of dialysis to its patient populations.
- The ORN (Ontario Renal Network), a division of Cancer Care Ontario, an agency of the provincial government, manages the delivery of chronic kidney disease (CKD) services in the province. Under The Ontario Renal Plan II, work is currently underway to advance Ontario's Declaration of Partnership and Commitment to Action regarding palliative care, and integrate palliative care into CKD programs across Ontario.

On another note, as the CANNT Liaison for the Canadian Nurses Association (CNA), it behooves me to promote certification in nephrology [CNeph(C)] as a great way to demonstrate expertise and dedication to your practice in nephrology. Interested applicants should note there are significant changes to the specialty certification exams effective this year. If you are interested in joining the growing network of CNA-certified RNs at the leading edge of health care, please note that the next CNA certification exams will be offered from **September 19 to October 7, 2016**. The online application process to apply for the 2016 exams will be open from **April 11 to July 1, 2016**. Visit the CNA website for more information. As a CANNT member, you can access the education portal on the CANNT website as a resource for certification preparation.

This is an exciting time for the nephrology community at large, as we continue to advance excellence in nephrology care with the different regional and institutional initiatives that are currently underway. Keep up the fantastic work and let's keep the momentum going!!

Respectfully submitted
Anne Moulton, CANNT President*

**Since the resignation of Anita Amos as CANNT President in December 2015, Anne Moulton, with the support of the Board of Directors, has resumed the role of President.*

Les vice-présidents de l'ACITN, en collaboration avec leurs collègues régionaux, nous ont fait part d'activités et de réalisations formidables partout au pays. En voici un aperçu :

- Rick Luscombe, infirmier-chef clinicien en accès vasculaire au Providence Health Care de Vancouver, en Colombie-Britannique, a reçu le prestigieux prix Wilma Crockett 2015 décerné par la BC Renal Agency. Le prix constitue une occasion pour la communauté œuvrant dans le domaine des greffes et transplantations rénales de la Colombie-Britannique de reconnaître les personnes qui ont apporté une contribution remarquable aux soins des patients dans la province. Rick, qui est cofondateur du Vascular Educators Group of BC, a aussi été président de l'ACITN en 2010 et, plus récemment, coprésident du Symposium annuel de l'ACITN qui s'est tenu à Vancouver en 2015.
- En décembre dernier, le Manitoba Centre for Health Policy a publié un rapport intitulé : « *Care of Manitobans Living with Chronic Kidney Disease* », qui décrit l'état de la maladie rénale au Manitoba et la croissance projetée des populations de patients en dialyse. Le rapport, rédigé conjointement par les Drs P. Komenda et N. Tangri, recommande des stratégies pour la prise en charge des populations de patients en dialyse, notamment l'augmentation du recours à la dialyse à domicile.
- Le *Kidney Health Strategic Clinical Network,* composé de fournisseurs de soins de santé passionnés et bien informés de l'Alberta, a été lancé le 8 janvier 2016. Créé pour améliorer les soins et l'état de santé des patients atteints de maladies rénales, le réseau entend trouver de nouvelles façons innovatrices d'offrir des soins d'une plus grande qualité et d'une plus grande valeur afin de produire de meilleurs résultats auprès des patients.
- Le REINQ (Regroupement visant l'excellence de la pratique infirmière en néphrologie au Québec) a tenu son événement annuel en octobre 2015, auquel a participé un très grand nombre d'infirmières et infirmiers du Québec. Les sujets présentés comprenaient notamment un survol de la déontologie de la pratique infirmière, la prise de décisions et les soins en fin de vie, la décision de cesser les traitements, ainsi que la prise en charge du pied diabétique et de l'ulcère diabétique. Le REINQ organisera une journée pour les gestionnaires au début de 2016, et une journée sur l'accès vasculaire est prévue au printemps 2016.
- Le suicide assisté par un médecin constitue un sujet de discussion important dans toutes les sphères des soins de santé au Québec. Le ministère de la Santé se penche à nouveau sur l'organisation des traitements de suppléance rénale. Le CHUM (Centre hospitalier de l'Université de Montréal) déménagera dans ses nouveaux locaux en 2016 et est en train de réorganiser la prestation de ses services de dialyse à ses populations de patients.
- Le Réseau rénal de l'Ontario (RRO), une division d'Action Cancer Ontario, est un organisme du gouvernement provincial qui gère la prestation de services aux personnes atteintes de maladies rénales chroniques (MRC) dans la province. Dans le cadre du Plan rénal de l'Ontario II, du travail est en cours pour faire progresser la *Déclaration de partenariat et engagement pour l'action de l'Ontario* concernant les soins palliatifs afin de les intégrer aux programmes de traitement des MRC partout en Ontario.

Dans un autre ordre d'idées, en tant qu'agent de liaison entre l'ACITN et l'Association des infirmières et infirmiers du Canada (AIIC), il m'incombe de promouvoir la certification en néphrologie [CNeph(C)] comme une excellente façon de démontrer votre expertise et votre dévouement dans votre pratique en néphrologie. Les personnes intéressées devraient prendre note que des changements importants seront apportés aux examens

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de certification pour la spécialité à compter de cette année. Si vous désirez vous joindre au réseau grandissant d'infirmières et infirmiers certifiés par l'AIIC qui sont à la fine pointe en matière de soins de santé, veuillez prendre note que les prochains examens de certification de l'AIIC seront offerts du **19 septembre au 7 octobre 2016**. Le processus d'inscription en ligne aux examens de 2016 se tiendra du **11 avril au 1er juillet 2016**. Visitez le site Web de l'AIIC pour plus de renseignements. En tant que membre de l'ACITN, vous pouvez accéder au portail d'éducation du site Web de l'ACITN pour vous aider à préparer l'examen de certification.

Il s'agit d'une période excitante pour l'ensemble de la communauté en néphrologie alors que nous continuons à faire progresser l'excellence dans notre spécialité avec les différentes initiatives régionales et institutionnelles qui sont en cours. Continuez votre excellent travail et poursuivons sur notre lancée!!

Article soumis par
Anne Moulton, présidente de l'ACITN*

** Depuis la démission d'Anita Amos au poste de présidente de l'ACITN en décembre 2015, Anne Moulton occupe à nouveau le poste de présidente avec l'appui du Conseil d'administration.*

CANNT: Your Board in Action

Thank you, Roberta Prettie, former CANNT Past President, for your 2015 Board in Action reports.

The Board in Action report provides our members with current and proposed activities of the Board of Directors (BOD). The BOD typically consists of eight elected members: President-Elect, President, four Vice-Presidents (Western, Ontario, Atlantic, and Technical), and Website/Treasurer. The Journal Co-editors and our office administration staff complete the BOD. Your Board in Action will appear in each quarterly *CANNT Journal*.

The elections to the BOD this year will include a President Elect/Treasurer position and a new position, Director of Communication. These changes were voted in by the membership at our 2015 Annual General Meeting (AGM) in Vancouver.

I feel very fortunate to be working with such a dedicated group of nephrology professionals. I would also like to acknowledge all the previous Board members who have volunteered their time and expertise to establish and maintain CANNT.

MEMBERSHIP

We currently have a membership of 515. Retaining and recruiting members is the key to our organization. The BOD continually strives to provide benefits to all our members. Share your CANNT experience with co-workers and share the benefits.

Benefits of membership:

- Access to our Members Only section of the CANNT website
- Access to our quarterly peer-reviewed online journal
- Eligibility for bursaries and grants, including CNA certification and re-certification in nephrology nursing
- Eligibility to nominate or be nominated for the annual awards
- Eligibility to run for a Board position
- "Booth in a Box" travelling road show about CANNT—brochures are included outlining the benefits of membership. Contact the CANNT office. We would be happy to ship "BOX" to your next event. We encourage photos of "BOX" and his travels. It would be great to send him from one end of Canada to the other!
- Downloadable version of the Nursing Standards of Practice and Vascular Access Guidelines (hard copies available at the CANNT National Office)
- Flexibility of a one-year membership at $75.00 plus tax or a two-year membership at $140.00 plus tax
- Half-price memberships for full-time student memberships

FINANCES

The CANNT BOD continues to focus on maintaining a viable organization by being fiscally responsible. Teleconferences are conducted monthly, thus reducing the cost of face-to-face meetings. E-mail communications and the use of small focus groups among the BOD members allow for the business of the organization to be conducted effectively with minimal expense to the organization.

JOURNAL

Our peer-reviewed quarterly journal is available in a downloadable version in the members-only section of the CANNT website. Articles are indexed in several databases.

Co-editors Jovina Bachynski and Matthew Phillips are doing a fantastic job providing education for our members. Your feedback is important to us—please send letters to our editors.

ALL members are encouraged to submit articles or research papers for publication. Guidelines for submission can be found under the "CANNT Journal" section of the CANNT website.

The journal also provides an opportunity to obtain Continuing Education hours. Start a journal club on your unit. Complete the post-tests. Each article provides an opportunity for growth in our practice, and provides those continuing education hours.

A Journal Award is also presented annually to the article voted on by a panel that has had the biggest impact on nephrology practice in Canada.

WEBSITE/SOCIAL MEDIA/COMMUNICATION

The CANNT website (**www.CANNT.ca**) provides many resources to keep our members connected and up to date as to what is happening in the world of nephrology. We encourage you to access the website for:

- Easy membership renewal—just click on "renew now" link
- Access to defined clinical practice groups (Home Dialysis Interest Group, Clinical Educators Network, Canadian Hemodialysis Access Coordinators and the Canadian Nephrology Nurse Practitioners)
- Discussion forum: Post a question and your peers from across Canada will provide feedback
- Links to upcoming nephrology events
- Contact information for members of the BOD, journal co-editors, and office administration staff

CANNT is active on Facebook … 800+ LIKES … I am hoping to report 1,000+ SOON! There is so much going on in the world of nephrology. If you have something you would like CANNT to share, please contact the BOD.

We are active on Twitter. Follow us @CANNT1 and share your nephrology news.

At the October 2015 AGM, we passed a motion to elect a Director of Communication. The BOD is currently working on the role and responsibilities of this new position. We are looking forward to growing this aspect of CANNT.

CANNT Connection emails are sent out to membership to keep members informed of upcoming events and important deadlines.

Letter to the Editor

Your donations of reusable clothing and household items continues to make an impact in supporting the 1 in 10 Canadians living with or at risk of developing kidney disease. Thanks to your generosity, Kidney Clothes diverted approximately 8.7 million pounds of reusable items from landfills in Ontario in 2015.

Donating your used clothing and cloth-based items has never been easier. Donors can schedule a free pick up at home by calling 1-800-414-3484.

Kidney disease affects 1 in 10 Canadians. A diagnosis of kidney failure is life-changing. With no known cure, people living with end stage kidney failure must rely on either dialysis or a kidney transplant to survive. Funds raised through the Kidney Clothes program support The Kidney Foundation's mission to support innovative kidney research, provide education and support to people living with kidney disease and their families, and to increase awareness about kidney health and organ donation.

Thank you for your generous support. For more information on how you can help, please check us out on Facebook or email us at **info@kidneyclothes.ca**

Sincerely,
Team Kidney Clothes

ANNUAL CONFERENCE

The CANNT 2016 London *(Changing the Face of Tomorrow)* symposium co-chairs, Linda Downing and Barb Wilson, along with their planning committee, are working hard to create an innovative and exciting program with something for everyone. We hope to see you in London on October 27–29, 2016!

CANNT 2017 will be held in Halifax and we will celebrate CANNT's 50th anniversary at CANNT 2018! Planning is underway. Stay tuned.

Yours in nursing,
Heather Dean, CANNT President-Elect

NOTICE BOARD

- April 11 to July 1, 2016. CNA certification exam online application process open
- May 1–4, 2016. American Nephrology Nurses' Association (ANNA) 47th National Symposium, Marriott Louisville, Kentucky International Convention Center, Louisville, Kentucky. **www.annanurse.org**
- May 21–24, 2016. 53rd European Renal Association–European Dialysis and Transplant Association (ERA-EDTA) Congress, Austria Center Vienna, Vienna, Austria. **www.era-edta2016.org**
- September 17–20, 2016. 45th Annual European Dialysis and Transplant Nurses Association/ European Renal Care Association (EDTNA/ERCA) International Conference, The Valencia Conference Centre, Valencia, Spain. **queries@edtnaerca.org**
- September 19 to October 7, 2016. CNA certification exams offered
- September 21, 2016. Nephrology Health Care Professionals' Day
- October 27–29, 2016. Canadian Association Nephrology Nurses and Technologists (CANNT) 49th National Symposium 2016—Changing the Face of Tomorrow, London, Ontario. **www.cannt.ca**
- November 15–20, 2016. American Society of Nephrology (ASN) Kidney Week 2016, McCormick Place, Chicago, Illinois. **www.asn-online.org**
- CANNT Vascular Access Guidelines: available now in the members only section at **cannt.ca**!

CANNT is asking for expressions of interest for co-chairs for the 2017 CANNT National Conference in Halifax, and the 2018 CANNT National Conference in Quebec City. If you are a CANNT member from either of these cities, please email your expression of interest to the CANNT office.

CANNT 2015 – Reaching New Heights October 22–24, 2015, Vancouver, British Columbia

From October 22–24, the CANNT Board of Directors and CANNT 2015 Planning Committee hosted 573 colleagues in Vancouver, British Columbia at the beautiful Hyatt Regency Hotel. Our esteemed planning committee created a leading-edge program featuring local expertise and colleagues from across Canada. Concurrent sessions and plenary presentations reflected the theme of "Reaching New Heights", offering both evidence-based and experiential knowledge to conference attendees. Six workshops, three plenary sessions, 41 concurrent sessions, 51 poster presentations, and 40 exhibitor booths assisted the committee in achieving its goals. One of the many highlights this year was a two-day agenda dedicated to transplantation. A return of the one-day pediatric program was also very popular. We had 40 attendees involved in this stream. Another highlight this year was the attendance of 35 technologists and technicians who enjoyed a full conference of programming.

The conference plenary talks were outstanding. The conference opening ceremonies featured Mark Donnelly—born and raised in Vancouver, who has been singing the national anthem for the Vancouver Canucks since 2001. Deena Ebbert stirred incredible energy within the delegates with "FISH! Catch the Energy and Release the Potential", and Mary Poane shared her insights with the delegates with her message "ON TRAC (Transitioning Responsibility to Adult Care): Tools and Strategies for Your Practice". Messages of humour and motivation are always appreciated by delegates, and Valerie Cade did not disappoint with her message of "Encouragement for the Encouragers! Putting the Hope Back into Healthcare."

More than 215 delegates attended the Evening of Entertainment at the exquisite "Steamworks Brewery" … One cannot go to the brewery without being inspired and experiencing a fabulous evening! Adding to the evening's success were the Duelling Pianos, a musical group featuring two pianists who play all of your classical favourites. Continued commitment on behalf of our corporate sponsors, as outlined below, played a large part in the success of the conference, and we are always grateful for their generous support.

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The Board of Directors of CANNT is grateful to all who travelled from across Canada to participate in this year's conference. We trust that our host city of Vancouver delivered an exceptional experience for everyone.

The Board of Directors is also grateful to the CANNT 2015 Planning Committee for its dedication and commitment to creating a fantastic conference. Our thanks are extended to the following committee members:
Rick Luscombe, BSN, RN, CNeph(C)—Conference Co-Chair
Stan Marchuk, MN, NP(F), CNeph(C)—Conference Co-Chair
Wendy Baerg—Technical Rep
Tony Chacon, MN, RN, CNeph(C)
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Engaging health care providers to improve the referral and evaluation processes for potential transplant candidates—The Toronto General Hospital Experience

By Olusegun Famure, Heebah Sultan, Nicholas Phan, Michael Garrels, Lee-Anne Hyer, and S. Joseph Kim

ABSTRACT

The Kidney Transplant Program (KTP) at the Toronto General Hospital has taken great strides in preparing to meet the needs of patients and health care providers, as the number of end-stage renal disease patients in Ontario increases. The KTP has begun the process of increasing engagement and collaboration with various stakeholders from the pre- to the post-transplant phase through (1) the development of innovative programs to increase the number of live kidney donations, (2) the development and maintenance of information technology solutions that work simultaneously to provide data to manage and treat patients, and conduct research, and (3) the development, implementation, and delivery of educational presentations and tools to various stakeholders both at the referring centres and the transplant program. Future steps for the KTP include evaluating the impact of these programmatic tools and activities on the number of referrals received and the subsequent effect on the number of transplants performed.

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As of December 31, 2013, the Canadian Institute for Health Information (CIHI) reported that 41,931 Canadians were being treated for end stage renal disease (ESRD) (CIHI, 2015). Although kidney transplantation is the preferred form of renal replacement therapy (RRT) for most patients, approximately 58% (24,114) of Canadians treated for ESRD were on dialysis compared to 42% (17,817) who were living with a functioning kidney transplant (CIHI, 2015; Wolfe et al., 1999). Studies have shown that transplantation offers an increase in life expectancy and quality of life when compared to dialysis, particularly in those undergoing pre-emptive transplantation (CIHI, 2014; Tonelli et al., 2011; Wolfe et al., 1999). In addition, the decreased need for dialysis and repeated hospital admissions make kidney transplantation highly cost effective (Levy, 2009).

Guidelines for optimal timing of referral for kidney transplantation according to the *Canadian Society of Transplantation* state that: (1) potential transplant recipients should be referred for evaluation by a transplant program once initiation of renal replacement therapy is expected in less than 12 months, and (2) patients already requiring dialysis support should be referred for transplant evaluation as soon as their medical condition stabilizes (Knoll et al., 2005). It is necessary to develop a collaborative framework that engages health care providers and patients at referral sites and transplant centres in a way that optimizes the timing of referral, triaging patients to the appropriate health care providers throughout the pre-transplant process, and re-evaluating the effectiveness of the prescribed processes from both patients and the health care team.

THE KIDNEY TRANSPLANT PROGRAM, UNIVERSITY HEALTH NETWORK

The Kidney Transplant Program (KTP) at the Toronto General Hospital (TGH) in Canada is part of the Multi-Organ Transplant (MOT) Program, which is Canada's largest transplant program, specializing in kidney, heart, lung, liver, pancreas, and small bowel transplantation. ESRD patients' referral packages are received by the KTP's pre-transplant assessment coordinators from the referring site, which generally contains rudimentary patient medical and demographic information. The pre-transplant coordinators collaborate with the referring site to complete the

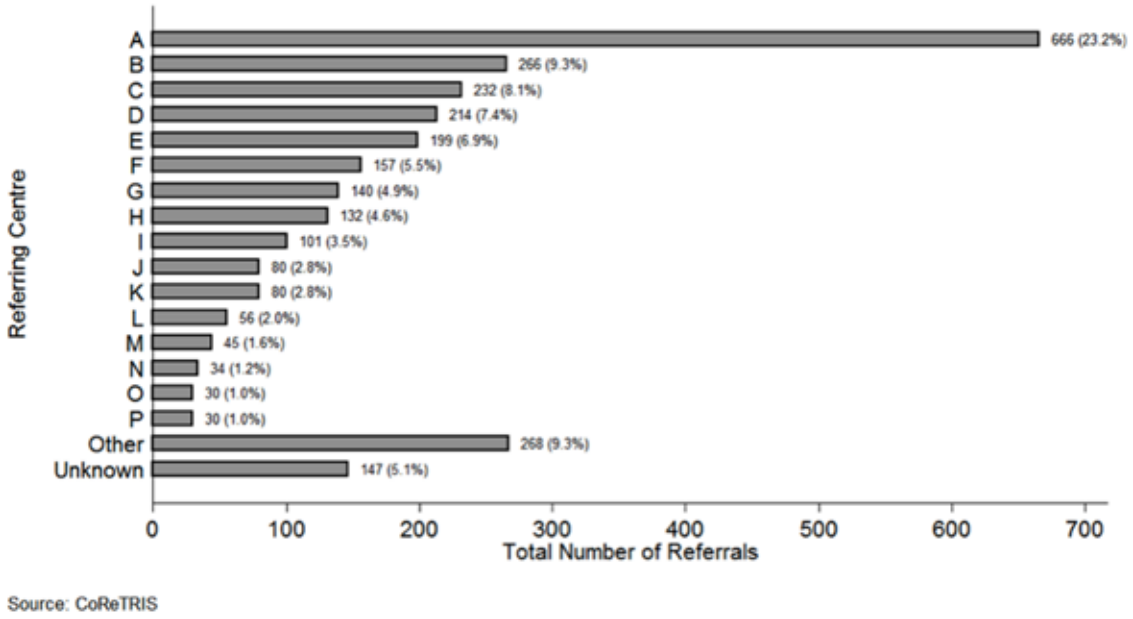

Figure 1: Number of newly referred patients for assessment of kidney transplant

package, which then aids the multidisciplinary team in screening potential candidates for kidney transplantation. The dialysis units at TGH, Credit Valley Hospital, Humber River Regional Hospital, Sunnybrook Health Sciences Centre, Lakeridge Health Corporation, William Osler Health System, and Peterborough Regional Health Centre are the most prominent referring sites to the KTP. The distribution of patients seen at TGH from various referring centres is depicted in Figure 1.

A total of 147 referrals had no information about their referring centres. Centres with fewer than 30 referrals were included as "Other".

Once the referral package is completed, the pre-transplant assessment process begins. This consists of a series of tests and consultations with the transplant team to determine the patient's transplant candidacy from both the medical and psychosocial perspectives. This is typically an iterative process, which starts after the transplant nephrologist reviews a preliminary round of investigations at the initial patient evaluation meeting. As a result, depending on the health status of the patient and the timeliness of their investigations, the duration of this step in the transplant process may vary from a few months to more than a year.

Following the pre-transplant assessment process, the referred patient will experience two possible outcomes: (1) the patient is deemed eligible for kidney transplantation (with subsequent activation onto the kidney transplant waiting list), or (2) the patient is deemed ineligible for kidney transplantation. Reasons for ineligibility may include: (1) the transplant is deemed premature (i.e., patient is not yet on dialysis and is asymptomatic), (2) transplant surgery is considered too high-risk for the patient (e.g., inoperable severe coronary heart disease), (3) the patient chooses not to be wait-listed, or (4) the patient has a potential living kidney donor available. From 2003–2013, approximately 2,877 patients were referred to the KTP (Figure 2), and, on average, 131 kidneys were transplanted annually during that time (Figure 3). Living donors have contributed to half of the centre's kidney transplants. Living organ donation is encouraged when possible in light of its superior clinical outcomes for both the kidney graft and the recipient. This is a finding that is evident in many clinical studies (Cecka, 1998; Lee et al., 2010) and supported by data generated by our own centre (Figure 4).

INNOVATIONS IN THE KTP

Program Highlights

Over the past 10 years, the KTP has increased opportunities for living donor kidney transplantation including the donor-specific anti-HLA antibodies (DSA) desensitization program, the ABO incompatible donor program, and the Living Donor Paired Exchange (LDPE) program. The DSA desensitization program uses medications and other immune-related treatments prior to transplant to reduce the level of incompatible antibodies in the recipient's blood and the donor's kidney, allowing a recipient to receive the donated organ despite being predisposed to a higher risk of rejection. The ABO incompatible donor program is a specialized part of the KTP that allows for donors with incompatible blood groups to their intended recipient to still donate a kidney. Recipients and donors are medically cleared for transplantation prior to starting any treatments. Recipients are initially given a set of medications in hospital and then undergo blood plasma exchange for a few sessions. ABO titers are measured multiple times during these treatments until they are low enough that the recipient can accept the kidney. Additional medications targeting the immune system may also be given. Since its inception

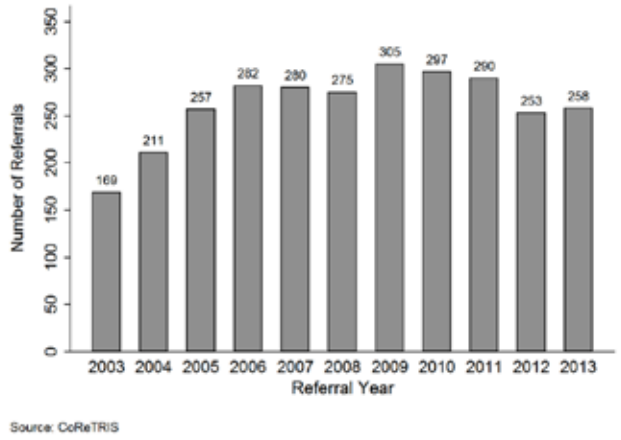

Figure 2: Number of newly referred patients for assessment of kidney transplant candidacy at the Toronto General Hospital from 2003 to 2013.

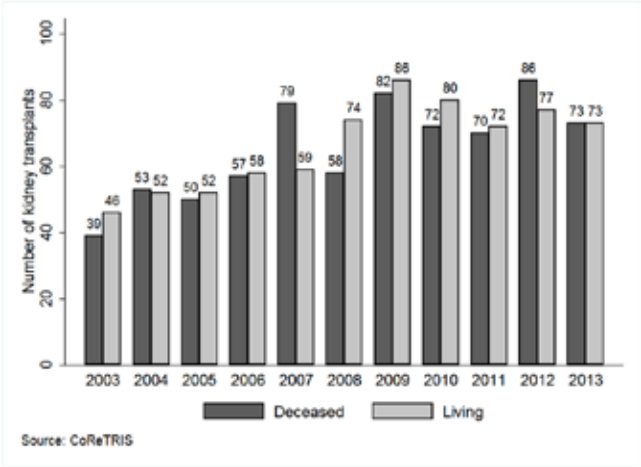

Figure 3: Number of patients transplanted between 2003 to 2013 by donor type.

in 2004 to the end of 2013, 88 patients have been transplanted through both programs. Though an increase in kidney transplantation can be seen seen through the utilization of these programs, they are not without clinical complications. Studies have shown significantly higher rates of acute rejection and antibody-mediated rejection rates, as well as lower five-year graft survival rates for desensitized patients, as compared to nonsensitized patients (Marfo, Lu, Ling, & Akalin, 2011).

The LDPE Program enables incompatible recipients and donors to find a match among other pairs of incompatible recipient-donors. This would allow both recipients to receive a kidney transplant. The LDPE has since evolved into a national program (administered by the Canadian Blood Services) where the KTP adds incompatible recipients and donors into a large pool of patients. Within this large pool of recipient-donor pairs, the LDPE can create multiple matches to maximize potential transplant options. Our program is one of the largest contributors of eligible recipient-donor pairs to the LDPE and has conducted numerous paired-exchange transplants.

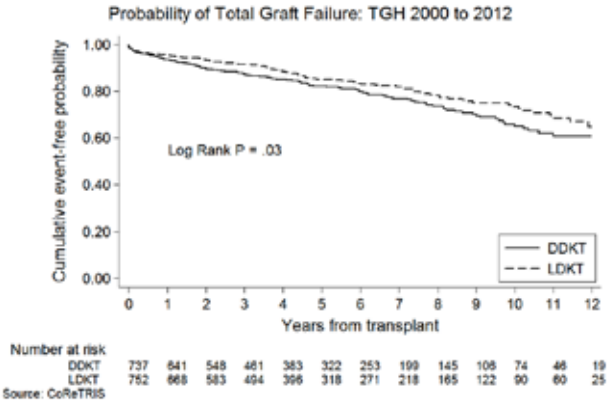

Figure 4: Probability of graft failure and death for deceased donor kidney transplants (DDKT) and living donor kidney transplants (LDKT).

Information Technology Infrastructure

In the late 1990s, the MOT program incorporated the Organ Transplant Tracking Record (OTTR) as its information technology solution for the clinical management and follow-up of transplant patients. Prior to the implementation of the OTTR system, patient information was recorded manually in spreadsheets and, thus, health care providers were heavily reliant on paper charts. Innovations in surgical techniques, immunosuppressant agents, and medical management led to increased patient and graft survival, which, thereby, led to an increased number of patients followed by the program. Therefore, the need for a computer-based solution for optimal clinical management became apparent. The advantage of utilizing OTTR is the instant access to real-time patient information and its ability to link to other UHN resources to pool patient information into one location. The system allows health care and research staff to see the historical progression of patients, trends over time, treatment outcomes, and areas for treatment improvement.

In an effort to evaluate our program's experiences related to overall patient management and outcomes, the Comprehensive Renal Transplant Research Information System (CoReTRIS) was developed as a central research platform to ensure reliable data for program quality improvement and research while rigorously protecting the confidentiality of patient health information (Famure, Phan, & Kim, 2014).

CoReTRIS is an amalgamation of three linked databases tracking patient information from kidney transplants conducted at TGH since January 1, 2000. The three databases include the pre-transplant, post-transplant, and the biological specimen repository information systems. The primary domains in CoReTRIS include data on recipients, donors, transplants, laboratory tests, pathology, treatments, diagnoses, outcomes, psychosocial measures, hospital cost, and patient satisfaction (Famure et al., 2014). CoReTRIS has been developed and maintained for the purpose of housing comprehensive, accurate, and timely data for clinical research on referred ESRD and kidney transplant patients. CoReTRIS serves not only as a research database; it also plays an integral

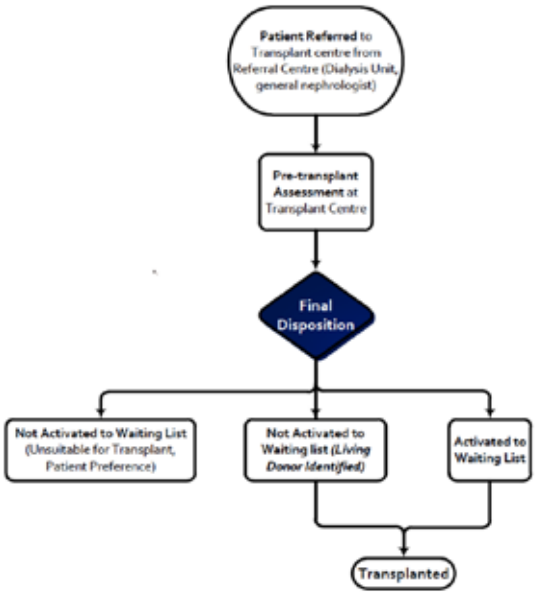

Figure 5: Pre-transplant referral and evaluation process for assessment of kidney transplant candidacy at the Toronto General Hospital.

part in developing and updating the KTP's educational tools and activities designed for both health care providers at referring sites, as well as for ESRD and transplant patients. The database is also used as a quality assessment tool to appraise and make transparent the KTP's pre-transplant processes, post-transplant outcomes, and develop program benchmarks.

Primary performance metrics used to assess the pre-transplant process are derived from the health services performance measures in CoReTRIS, and include two main time periods: (1) time from referral to the KTP to the initial evaluation by a transplant nephrologist or surgeon at TGH, and (2) time from the initial evaluation to when the final disposition of a patient is determined (Figure 5). Other metrics of interest include: (a) number of referrals from each referring site per year, (b) length of time on dialysis to first referral, (c) composition of comorbidities that referred patients present with at the time of first visit, (d) wait-list mortality rate, and (e) time from referral to transplant by the type of transplant (deceased versus living donor).

ENGAGEMENT AND COLLABORATION

A two-pronged approach was recently introduced to the KTP program to increase engagement and collaboration between the KTP and our referring sites: (1) face-to-face engagement with the 'point of contact' at referring sites through educational presentations, and (2) telehealth consultations.

Educational Presentations

Several of the transplant nephrologists, pre-transplant coordinators, and allied health staff at TGH periodically provide comprehensive educational presentations, familiarizing referring sites with the transplant-related treatment options for ESRD patients, the medical management of transplant recipients, and outcomes at TGH. Topics covered include the differences in RRT (dialysis versus transplantation), the importance of pre-emptive transplantation, outcomes from deceased and living donor transplantation at TGH, and novel initiatives to increase opportunities for transplantation that are unique to the KTP program. Separate presentations are given for health care providers (nephrologists, nurses, and allied health staff) in order to tailor the content, as appropriate. During these presentations, our pre-transplant coordinators also review guidelines with health care providers concerning appropriate completion of referral packages to ensure that patients can efficiently progress through the pre-transplant process. The goal of these presentations is to increase dialogue and collaboration with referring sites and their patients through direct contact with the KTP's staff.

An important aspect of these educational presentations is to engage with the dedicated transplant coordinators (if available) at the referring centres. They become the primary 'point-of-contact' with the KTP since their main responsibility is to help local ESRD patients navigate the transplantation process. To ensure effective communication between the referring site and the transplant centre, this collaboration improves the coordination of pre-transplant testing and the successful completion of referral packages. Although not all referring sites have the resources to dedicate a staff member to be the 'point of contact' to the transplant centre, pre-transplant assessment coordinators at the KTP work with referring sites to strategize on the best approach to facilitate the patient transplant evaluations in a timely and appropriate manner.

Patient Educational Tools

Our program has developed and currently utilizes three patient engagement tools geared toward living donors, ESRD patients, and their support groups: (1) the *Kidney Transplant Recipient* manual, (2) the *Donating a Kidney (Living Donor)* manual, and (3) the *Kidney Pulse* newsletter. These tools are provided to patients at referring sites during the educational presentations at the pre-referral stage, at the pre-transplant referral and evaluation stage, and during post-transplant follow-up care.

The *Kidney Transplant Recipient* and the *Donating a Kidney* manuals are received by all potential transplant recipients and living donors referred to the KTP. These manuals provide an informative overview of kidney transplantation and donation processes, which includes: (a) an explanation of kidney function, (b) introduction of the members of the transplant team and their roles, (c) outline of the transplantation and donation surgeries, (d) review of the immunosuppressant medications and their side effects, and (e) an overview of the importance of self-care management pre- and post-transplant.

The *Kidney Pulse* is a biannual newsletter that integrates all aspects of pre- and post-transplant care including surgery, medicine, nutrition, psychosocial issues, and clinical research. Six issues have been published since the newsletter's inception in 2011. Each issue has a focused theme and features educational articles written by a multidisciplinary staff on the given topic. The purpose of the *Kidney Pulse* is to engage and educate patients, their support groups, and living donors through the dissemination of relevant and trustworthy information.

Currently, the newsletter is distributed to patients during their post-transplant clinic visits at transplant-related events and to select referral sites and dialysis centres.

Telehealth Consultations

Our transplant physicians and pre-transplant coordinators regularly conduct telehealth consultations with distant referring centres. During these consultations, both parties review patients to be referred and assess patients undergoing review for re-activation to the waiting list after being placed on hold due to medical complications. These methods of communication increase collaboration with the referring sites, who continue to provide care for patients until they receive a transplant. If patients unfortunately lose their graft, they tend to return to their referring centre to resume dialysis treatment. Therefore, engaging referring centres in the patient's transplant journey is a necessary component of an integrated plan to provide optimal care.

FUTURE DIRECTIONS

Attempting to comprehensively understand the ways that our transplant centre can effectively communicate, engage, and collaborate with referring centres, patients, and their support groups has been an important learning opportunity to increase access to transplantation while improving our services for ESRD patients.

Providing referral centres with a comprehensive profile of our program, via a formal annual report, is one of the engagement tools currently in progress. Such reports, augmented with data tailored to the centre's referred patients and their outcomes, are one of the few ideas being executed to enhance our relationship with referring centres. Such tools would be instrumental in allowing referring sites' healthcare providers and ESRD patients to assess how well patients from their respective sites fare in our program during both their evaluation and transplant phases. Patients would be tracked to monitor the duration of their pre-transplant process, the length of time wait-listed, and finally post-transplant survival and graft outcomes. Making our existing educational tools, such as the *Kidney Transplant Recipient* manual and the *Kidney Pulse,* accessible online through our program's website is a key priority. In addition, increasing opportunities for community health care providers to become regular contributors to the *Kidney Pulse* newsletter is an initiative currently being explored.

Other new educational tools that are being developed by the KTP include a *Kidney Transplant FACT Booklet* targeting ESRD patients and their support groups and a *Clinical Research Brochure* to raise awareness among newly referred patients regarding research opportunities that they may participate in during the transplant evaluation. The wider dissemination of the IMPACT news bulletin to referred patients is also being explored. The IMPACT bulletin is a vehicle for our program to disseminate information on research in the area of kidney transplantation while educating patients about research practice, the need for research, why they should consider participating in research studies, and updating readers on current studies in which the program is involved. Future steps for the KTP include evaluating the impact of these programmatic tools and activities on the number of referrals received, and the subsequent effect on the number of transplants performed.

CONCLUSION

The engagement tools and presentations provided to referring sites as well as ESRD and transplant patients have been an integral part of our program's initiative to improve stakeholder engagement. With the rising number of ESRD patients in Ontario, timely referrals and streamlining the pre-transplant process is critical. This can potentially be achieved through combining early education about transplantation for patients, the provision of appropriate guidelines on completing referral packages to referring centres, timely transplant evaluation by the KTP, and helping patients identify potential living donors. The role of increased communication and engagement with healthcare providers at referring centres and patients using the aforementioned tools is an important element to achieving these goals.

REFERENCES

Canadian Institute for Health Information. (2014). *Canadian Organ Replacement Register annual report: Treatment for end-stage organ failure in Canada, 2003 to 2012*. Ottawa, ON: CIHI.

Canadian Institute for Health Information. (2015). *Canadian Organ Replacement Register annual report: Treatment for end-stage organ failure in Canada, 2004 to 2013*. Ottawa, ON: CIHI.

Cecka, M. (1998). Clinical outcomes of renal transplantation: Factors influencing patient and graft survival. *Surgical Clinics of North America, 78*(1), 133–48.

Famure, O., Phan N., & Kim, S. J. (2014). Health information management for research and quality assurance: The comprehensive renal transplant research information system. *Health Management Forum, 27*(1), 30–36.

Knoll, G., Cockfield, S., Blydt-Hansen, T., Baran, D., Kiberd, B., Landsberg, D., … Cole, E. (2005). Canadian Society of Transplantation consensus guidelines on eligibility for kidney transplantation. *Canadian Medical Association Journal, 173*(10), 1181-1184.

Lee, S., Kim, J., Shin, M., Kim, E., Moon, J. Jung G…Kim, S. (2010). Comparison of outcomes of living and deceased donor kidney grafts survining longer than 5 years in Korea. *Transplantation Proceedings, 42*(3), 775–7.

Levy, G. (2009). *Report of the organ and tissue transplantation wait times expert panel.* Ontario: Ministry of Health and Long-Term Care.

Marfo, K., Lu, A., Ling, M., & Akalin, E. (2011). Desensitization protocols and their outcome. *Clinical Journal of the American Society of Nephrology, 6,* 922–936.

Tonelli, M., Wiebe, N., Knoll, G., Bello, A., Browne, S., Jadhav, D., … Gill, J. (2011). Systematic review: Kidney transplantation compared with dialysis in clinically relevant outcomes. *American Journal of Transplantation, 11*(10), 2093–2109.

Wolfe, R.A., Ashby, V.B., Milford, E.L., Ojo, A.O., Ettenger, R.E., Agodoa, L.Y., … Port, F.K. (1999). Comparison of mortality in all patients on dialysis, patients on dialysis awaiting transplantation, and recipients of a first cadaveric transplant. *New England Journal of Medicine, 341*(23), 1725–1730.

CONTACT HOUR: 2.0 HRS

Update on phosphate binders: The old and the new

By Jacob Cashin and Marisa Battistella

LEARNING OBJECTIVES

After reading this article, the reader should be able to:

1. Describe the prevalence of hyperphosphatemia in the hemodialysis population.
2. Explain the pathophysiology and identify important long-term consequences of hyperphosphatemia in patients receiving maintenance hemodialysis.
3. Differentiate between the types of oral phosphate binders used and be able to outline their respective roles in therapy.
4. Discuss newer phosphate binders available, such as iron-based phosphate binder therapies.

Hyperphosphatemia is a common complication of end-stage renal disease (ESRD), and is a known risk factor for cardiovascular morbidity and mortality (Kuhlmann, 2006). In addition to its negative effects on the cardiovascular system, hyperphosphatemia can also lead to abnormalities in bone metabolism. These derangements of the bone are commonly referred to as Chronic Kidney Disease-Mineral Bone Disorder (CKD-MBD), a syndrome that is relatively asymptomatic, but can increase the risk of fractures (Tomasello, 2007). Furthermore, it has also been shown that hyperphosphatemia can increase the risk for hospitalizations (Vaiciuniene, Kuzminskis, Ziginskiene, Skarupskiene, & Bumblyte, 2011).

Treatment of hyperphosphatemia in ESRD patients generally involves removing phosphate via hemodialysis, restricting dietary intake of phosphate, and use of oral phosphate binders. Dietary restriction alone, however, is not sufficient in controlling serum phosphate levels in patients with advanced kidney disease, and can result in malnutrition. For this reason, prescription of a phosphate binder is often used to adjunctively manage hyperphosphatemia (Malberti, 2013). This review will focus on the use of phosphate binders for patients on hemodialysis (HD).

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PATHOPHYSIOLOGY OF HYPERPHOSPHATEMIA IN CHRONIC KIDNEY DISEASE

Phosphate is one of the most abundant elements in the human body. The majority of phosphate is found in the bones and teeth, with only around 1% existing extracellularly in the plasma (Bellasi, Kooienga, & Block, 2006). The normal plasma phosphate concentration in healthy adults ranges from 0.80 to 1.45 mmol/L, and is the result of a balance between dietary intake, intestinal absorption, and urinary phosphate excretion (Bellasi et al., 2006).

The kidneys play a large role in regulating the excretion of phosphate from the body. Chronic damage to the kidneys impairs the body's ability to maintain phosphate balance, and dysregulation of phosphate homeostasis occurs (Hruska, Mathew, Lund, Qiu, & Pratt, 2008).

Hyperphosphatemia is common in the late stages of CKD, and often disrupts the regulation of other inter-related processes such as the regulation of parathyroid hormone (PTH) by the parathyroid gland. High phosphate levels stimulate the parathyroid gland to produce and release PTH in an attempt to decrease the reabsorption of phosphate via the kidneys and promote excretion in the urine (Tomasello, 2007). Phosphate has a high affinity for calcium and, thus, high serum concentrations of phosphorus increases the risk of calcium and phosphorus binding and precipitating in the blood (Tomasello, 2007). This can lead to vascular calcification, which is highly correlated with morbidity and mortality related to adverse cardiovascular events (Zhu, Mackenzie, Farquharson, & Macrae, 2012).

Hypocalcemia is another consequence related to the precipitation of the calcium-phosphate product, and results in further production and secretion of PTH by the parathyroid gland. Furthermore, both the decrease in kidney function and hyperphosphatemia lead to decreased activation of vitamin D3. This leads to further decreases in serum calcium concentrations and once again stimulates the parathyroid gland to produce and secrete PTH (Tomasello, 2007). Therefore, chronically high levels of serum phosphate lead to a series of changes with respect to bone metabolism and can ultimately lead to CKD-mineral bone disorder (Figure 1).

MANAGEMENT OF HYPERPHOSPHATEMIA

A multi-faceted approach is generally used to manage hyperphosphatemia, and generally includes dietary restriction of phosphate, hemodialysis (for ESRD patients), and

Figure 1: Derangements of Bone Metabolism in Chronic Renal Failure.
NKF-KDOQI (2003).

with oral phosphate binders. Although dietary measures and hemodialysis are important in controlling serum phosphate, this review will focus on phosphate binders.

Over the past several decades, many different types of phosphate binders have been developed for the treatment of hyperphosphatemia. These agents are often categorized into calcium-based (calcium acetate, calcium carbonate, and calcium citrate) and calcium-free binders (aluminum hydroxide, sevelamer hydrochloride, sevelamer carbonate, lanthanum carbonate, nicotinamide, and magnesium carbonate), all of which are effective in lowering serum phosphate (Malberti, 2013). Given the comparable efficacy of all these agents, selection is often based on other important considerations such as patient tolerability and cost (Malberti, 2013). It should be noted that phosphate binders must be taken with food in order to be effective, ideally at the start of the meal (i.e., with the first bite). The prescribed dose is based on the total phosphate content (phosphate "load") of the meal. For example, one 1,250 mg tablet of calcium carbonate (contains 500 mg of elemental calcium) can bind approximately 50 mg of phosphate (National Kidney Foundation [NKF], 2003). Therefore, dietitians are key to assessing the patient's diet and helping with the dosing of phosphate binders. A comparison of the available phosphate binders can be found in Table 1.

Aluminum-based binders. Introduced in the 1970s, the first phosphate binders included aluminum salts. Despite the excellent efficacy of these agents in reducing serum phosphate levels, their use was later restricted due to concerns of central nervous system (CNS), hematological, and bone toxicities related to accumulation of the aluminum (Yagil et al., 2015). Patients with end-stage renal disease (ESRD) are particularly susceptible to adverse effects related to cumulative ingestion of aluminum-containing compounds, as the removal of large amounts of aluminum by dialysis is not possible due to plasma protein binding (Salusky, 2006).

Although extremely effective, aluminum-based binders currently have a very limited role in therapy, and are generally reserved as a last resort for short-term use in patients with excessively high serum phosphate levels (DiPiro et al., 2014). When used short-term, aluminum-based binders' adverse effects are generally limited to gastrointestinal (GI) side effects such as constipation, nausea, and stomach cramps (DiPiro et al., 2014). In terms of cost, they are relatively inexpensive and widely available as an over-the-counter product in Canadian pharmacies.

Calcium-based phosphate binders. Calcium-containing binders have long been the most commonly prescribed phosphate binders due to their wide availability and relatively low cost. They also have an agreeable safety profile, with the most common side effects being gastrointestinal-related, mainly constipation and GI upset (NKF, 2003). They first rose to popularity after aluminum-based binders were found to have toxic central nervous system effects (Bellasi et al., 2006). Despite being safer than aluminum, calcium binders do not have as high an affinity for phosphate as aluminum and, thus, require higher doses to achieve the same level of serum phosphate control (Bellasi et al., 2006). Furthermore, calcium-based agents do not come without risk. The additional calcium intake can increase the total body calcium load and can lead to hypercalcemia (Salusky, 2006). The concerns of calcium loading led the NKF Kidney Disease Outcomes Quality Initiative (NKF KDOQI) group to recommend limiting the total calcium intake from all sources to 2 g/day, including calcium supplemented from binders (Taksande & Worcester, 2014). The problem is that many patients may require up to 6.5 g of calcium carbonate (contains 2.6 g of elemental calcium) to control phosphate levels, based on a 1,000 mg/day phosphate diet (Taksande & Worcester, 2014). There is also growing evidence to suggest there is increased risk of both cardiovascular and soft tissue calcification with prolonged use of these agents (Salusky, 2006). More data are needed to adequately assess the risk for adverse cardiovascular outcomes.

In addition to side effects, there are some clinically significant drug interactions with calcium-based phosphate binders that should be noted. Antimicrobial agents are implicated, including fluoroquinolones (e.g., ciprofloxacin, levofloxacin) and tetracyclines (e.g., tetracycline, doxycycline). These antibiotics should be administered at least one hour prior to taking calcium products or three hours after (Tomasello, 2007). Other medications such as levothyroxine and oral iron supplements should also be separated in the same fashion in order to allow adequate absorption of these agents (Tomasello, 2007).

Table 1: Comparison of Common Phosphate Binders Available in Canada

Binder	Dosage Forms	Trade Names	Dose (Mineral Content)	Potential Advantages	Potential Disadvantages
Aluminum hydroxide[a]	Tablets	Amphojel®	600 mg (208 mg elemental)	Relatively inexpensive, wide variety of products Calcium-free Highly effective phosphate binder	Constipation is common, chalky taste, aluminum toxicity with long-term use
	Liquid	Almagel Plus®	200 mg/5 mL (69.3 mg/5 mL elemental)		
Calcium carbonate[b, c]	Tablets	TUMS®	500 mg (200 mg elemental)	Inexpensive, wide variety of products Effective phosphate binder	Constipation, belching, and flatulence are common side effects. Can also cause hypercalcemia.
		TUMS® Extra Strength	750 mg (300 mg elemental)		
		TUMS® Ultra	1000 mg (400 mg elemental)		
		Webber Naturals® Calcium Carbonate	1250 mg (500 mg elemental)		
Lanthanum carbonate	Tablets	Fosrenol®	250 mg, 500 mg, 750 mg, 1000 mg	Available as chewable tablets Effective phosphate binder	Nausea, diarrhea, and abdominal pain common. Expensive, not covered by most provincial drug plans*
Sevelamer hydrochloride	Tablets	Renagel®	800 mg	Non-calcium, non-aluminum Effective phosphate binder	Nausea, diarrhea, and abdominal pain common. Large pill burden Expensive Cannot crush or chew
Sevelamer carbonate	Tablets	Renvela®	800 mg	Same as Renagel®	Same as Renagel®, except tablets can be crushed

[a,b] Many formulations exist; not all trade names and preparations are listed.
[c] Contains 40% elemental calcium.
*Specific criteria for coverage exist in each province.
†This is not a comprehensive list. Some formulations not listed as they are no longer available in Canada.

There are several calcium-based phosphate binder products on the market, such as calcium acetate, calcium carbonate, and calcium citrate, which come in a variety of formulations. Calcium acetate is no longer available in Canada; calcium citrate is quite expensive and rarely used. Calcium carbonate, for example, contains 40% elemental calcium and can be purchased as a single ingredient formulation or as part of various antacid products (e.g., TUMS®, TUMS Ultra®). In order to maximize efficacy, calcium-based phosphate binders should be taken with food at the start of the meal. Higher doses of binders may be required for meals containing a larger phosphate load.

Sevelamer hydrochloride and sevelamer carbonate. Sevelamer hydrochloride is a non-absorbable polymer that contains neither aluminum, lanthanum, or calcium. It is the first of its kind and was first marketed in 1999 as Renagel® for the treatment of hyperphosphatemia in hemodialysis patients (Cozzolino, Rizzo, Stucchi, Cusi, & Gallieni, 2012). Sevelamer is a hydrogel that contains amines, which can bind phosphate and make sevelamer effective in controlling serum phosphate levels (Cozzolino et al., 2012). It does not contain calcium, making it a favourable choice for patients with high serum calcium levels (Cozzolino et al., 2012). Given the cost of sevelamer relative to calcium-based phosphate binders, its use in clinical practice is often limited to the treatment of hyperphosphatemia in patients at risk for hypercalcemia. Its access is further limited due to the fact that it is not covered by most provincial drug plans in Canada, unless both calcium and phosphate levels are elevated for a documented period of time (as set by the provincial drug plan provider in each province). For instance, Ontario's Exceptional Access Program (EAP) requires documentation of two instances of elevated serum phosphate (greater than 1.8 mmol/L) and calcium (greater than 2.65 mmol/L) at least one month apart.

Another caveat of sevelamer is that often a large number of tablets are required to adequately control phosphate levels. This can be a significant burden on a patient's everyday life, and may result in lower adherence rates (Gray, Krishnasamy, Vardesh, Hollett, & Anstey, 2011). Adverse effects of sevelamer are primarily gastrointestinal-related, and include nausea, bloating, and constipation (Tomasello, 2007). It is important that sevelamer tablets and capsules be swallowed whole, and not crushed or chewed, as sevelamer is insoluble in water. This limits its use to patients with intact swallowing capabilities and makes the drug unavailable by other routes of administration such as nasogastric and entero-gastric feeding tubes (Tomasello, 2007). Relevant drug interactions for sevelamer are similar to those for calcium-based binders, and include ciprofloxacin, levothyroxine, and tetracycline antibiotics (Sanofi-Aventis Canada Inc., 2014). These agents should be administered separately from sevelamer, either one hour prior or two hours after the binder.

Sevelamer carbonate (Renvela®) is a similar compound, and is derived from sevelamer hydrochloride. It exists as a buffered form of the original drug, and studies suggest that it may be better tolerated than sevelamer hydrochloride, although this finding is not consistent (Cozzolino et al., 2012). The main advantage of the carbonate form is that it can be crushed, but both sevelamer compounds have similar phosphate-binding capabilities (Biggar & Ketteler, 2010).

Lanthanum carbonate. Lanthanum carbonate (Fosrenol®) is a non-aluminum, non-calcium phosphate binder that first gained approval from Health Canada in 2006 for the treatment of hyperphosphatemia in dialysis patients (Health Canada, 2007). Like aluminum, it is a trivalent heavy metal and is an effective phosphate binder. However, lanthanum has a better overall safety profile. It is not believed to cross the blood-brain barrier, alleviating concerns of adverse neurological effects related to CNS toxicity (Bellasi et al., 2006).

Lanthanum has been shown to have similar efficacy to calcium-based phosphate binders in terms of controlling serum phosphate, with fewer incidences of hypercalcemia (Salusky, 2006). Furthermore, lanthanum tablets with higher dosage strengths allow for a reduction in pill burden, which may improve adherence to therapy (Malberti, 2013). It is generally supplied only as a chewable tablet, as it must be sufficiently pulverized in order to exert its phosphate-binding effect (Okamoto et al., 2014). This essentially limits lanthanum phosphate binder therapy to those with sufficient ability to masticate and swallow the pulverized tablet.

Although lanthanum is a calcium-free alternative and is effective in achieving control of phosphate levels in the plasma, there is some concern with regards to accumulation of lanthanum. This is a reasonable concern, given the toxicity found with the cumulative ingestion of aluminum-based binders. Results from a recent systematic review, however, suggest that accumulation of lanthanum in both the serum and bone is minimal and is well below toxic levels (Zhang, Wen, Li & Fan, 2013). Despite the fact that side effects related to lanthanum therapy are generally limited to gastrointestinal adverse effects, its use as a phosphate binder has not been shown to have any benefit in terms of mortality, as compared to the previously mentioned phosphate binders (Zhang et al., 2013). Moreover, lanthanum is expensive and is not covered under most provincial plans without sufficient documentation of elevated serum calcium and phosphate. The criteria for coverage are similar to that of sevelamer hydrochloride (Renagel®). Relevant drug interactions with lanthanum are similar to the aforementioned phosphate binders (i.e., fluoroquinolone antibiotics, levothyroxine, tetracycline antibiotics), all of which should be separated from lanthanum by two hours when administered.

Magnesium salts. Magnesium-based phosphate binders were first introduced in the mid 1980s, as a replacement for aluminum-containing binders (Malberti, 2013). Available as magnesium carbonate and magnesium hydroxide, both agents are effective in binding phosphorus. Despite their efficacy, use of magnesium salts in current clinical practice is limited given that diarrhea and hypermagnesemia are common adverse effects at doses above 2 g per day (Malberti, 2013).

Niacin (nicotinamide). Niacin, or nicotinic acid, is a form of the water-soluble vitamin B3. Nicotinamide is the amide form of niacin and can be used as a phosphate binder. Its use in practice, however, has largely been abandoned due to side effects such as facial flushing and concerns over disproportionate increases in phosphate absorption when doses are skipped or are too low (Ketteler & Biggar, 2013).

Iron-containing phosphate binders. Recent studies have evaluated the use of novel, iron-containing phosphate binders for the treatment of hyperphosphatemia. Several compounds, such as ferric citrate, iron-magnesium hydroxycarbonate, and sucroferric oxyhydroxide, have undergone clinical trials for evaluation of efficacy and safety (Negri & Torres, 2014).

Ferric citrate has been used in Japan for the treatment of anemia in ESRD patients, and has recently been approved by the U.S. Food and Drug Administration (FDA) as an oral treatment for hyperphosphatemia in chronic kidney disease (Negri & Torres, 2014). After administration, ferric citrate dissociates into two components. One of these components, a ferric ion (Fe3+), can then bind to multiple phosphate (PO4-) ions and form a precipitate that allows the iron-phosphate complex to be eliminated in the stool.

In addition to their ability to reduce phosphate levels, there is evidence to suggest that iron-containing phosphate binders may also provide benefit to anemic patients by repleting iron stores needed for hemoglobin production (Rodby et al., 2015). In a 2014 phase III study, ferric citrate was found to be non-inferior to sevelamer in terms of serum phosphate reduction, and was also shown to increase both transferrin saturation and ferritin levels. The clinical relevance of this, however, cannot yet be established (Negri

& Torres, 2014). This could, in theory, result in cost-savings to health care systems by reducing the need for administration of intravenous iron in practice (Rodby et al., 2015). The ferric ion (Fe3+), however, must be converted to the ferrous ion (Fe2+) in the intestinal lumen in order to be absorbed. Because of this, the extent to which iron absorption occurs is not known, but it is expected to be limited compared to other commercially available oral iron preparations (Pennoyer & Bridgeman, 2015).

The most common side effects of ferric citrate found in clinical studies were stool discolouration and constipation (Negri & Torres, 2014). This is not surprising given the side effect profile of already available iron salts that have long been used for supplementation in patients with iron deficiencies. Relevant drug interactions for ferric citrate are similar to those of previously mentioned phosphate binding agents with the addition of bisphosphonates, levodopa, and methyldopa, all of which should be administered at least two hours apart from ferric citrate (Negri & Torres, 2014). In terms of dosing, the manufacturer recommends two tablets administered orally, three times daily with food (Keryx Biopharmaceuticals, Inc., 2014). It should be noted that iron-containing phosphate binders are not yet available in Canada.

CONCLUSION

Many phosphate binders exist on the market for the treatment of hyperphosphatemia in dialysis patients, all of which are effective in reducing serum phosphate levels. Given that many of the most common agents have similar efficacy and safety profiles, choice of phosphate binders for dialysis patients should be focused on cost, convenience, and patient-specific comorbidities. There are newer phosphate binders, notably iron-based salts, yet more clinical studies are needed before any distinct advantages or disadvantages can be elucidated.

REFERENCES

Bellasi, A., Kooienga, L., & Block, G.A. (2006). Phosphate binders: New products and challenges. *Hemodialysis International, 10*(3), 225–234. doi:10.1111/j.1542-4758.2006.00100.x

Bigger, P., & Ketteler, M. (2010). Sevelamer carbonate for the treatment of hyperphosphatemia in patients with kidney failure (CKD III – V). *Expert Opinion Pharmacotherapy, 11,* 2739–2750.

Cozzolino, M., Rizzo, M. A., Stucchi, A., Cusi, D., & Gallieni, M. (2012). Sevelamer for hyperphosphataemia in kidney failure: Controversy and perspective. *Therapeutic Advances in Chronic Disease, 3*(2), 59–68. doi:10.1177/2040622311433771

DiPiro, J.T., Talbert, R.L., Yee, G.C., Matzke, G.R., Wells, B.G., & Posey, L.M. (2014). *Pharmacotherapy: A pathophysiologic approach* (9th ed.). New York: McGraw Hill Medical.

Gray, N.A., Krishnasamy, R., Vardesh, D.L., Hollett, P.R., & Anstey, C.M. (2011). Impact of non-traditional phosphate binders and cinacalcet on haemodialysis patient biochemistry, pill burden and cost. *Nephrology, 16*(8), 688–696. doi:10.1111/j.1440-1797.2011.01482.x

Health Canada (2007). *Summary basis of decision (SBD): Fosrenol®.* Heath Products and Food Branch, issued on November 5, 2007.

Hruska, K.A., Mathew, S., Lund, R., Qiu, P., & Pratt, R. (2008). Hyperphosphatemia of chronic kidney disease. *Kidney International, 74*(2), 148–157. doi:10.1038/ki.2008.130

Keryx Biopharmaceuticals, Inc. (2014). *Auryxia (ferric citrate) prescribing information.* New York, New York.

Ketteler, M., & Biggar, P. H. (2013). Use of phosphate binders in chronic kidney disease. *Current Opinion in Nephrology and Hypertension, 22*(4), 413–420. doi:10.1097/mnh.0b013e32836214d4

Kuhlmann, M.K. (2006). Management of hyperphosphatemia. *Hemodialysis International, 10*(4), 338–345. doi:10.1111/j.1542-4758.2006.00126.x

Malberti, F. (2013). Hyperphosphataemia: Treatment options. *Drugs, 73*(7), 673-688. doi:10.1007/s40265-013-0054-y

National Kidney Foundation (2003). NKF KDOQI guidelines: KDOQI clinical practice guidelines for bone metabolism and disease in chronic kidney disease. *American Journal of Kidney Disease, 42*(4), Suppl 3. Retrieved from http://www2.kidney.org/professionals/kdoqi/guidelines_bone/background.htm

Negri, A.L., & Torres, P.A. (2014). Iron-based phosphate binders: Do they offer advantages over currently available phosphate binders? *Clinical Kidney Journal, 8*(2), 161–167. doi:10.1093/ckj/sfu139

Okamoto, H., Haruhara, K., Kamejima, S., Mafune, H., Manabe, M., Kanzaki, G., … Yokoo, T. (2014). Is granular formulation of lanthanum carbonate more effective than chewable tablets? *Therapeutic Apheresis and Dialysis, 18,* 23–27. doi:10.1111/1744-9987.12207

Pennoyer, A., & Bridgeman, M.B. (2015). Ferric citrate (Auryxia) for the treatment of hyperphosphatemia. *Pharmacy and Therapeutics, 40*(5), 329–339.

Rodby, R.A., Umanath, K., Niecestro, R., Bond, T.C., Sika, M., Lewis, J., & Dwyer, J.P. (2015). Ferric citrate, an iron-based phosphate binder, reduces health care costs in patients on dialysis based on randomized clinical trial data. *Drugs in R&D, 15*(3), 271–279. doi:10.1007/s40268-015-0103-y

Salusky, I.B. (2006). A new era in phosphate binder therapy: What are the options? *Kidney International, 70,* S10–S15. doi:10.1038/sj.ki.5001997

Sanofi-Aventis Canada Inc. (2014). Renagel product monograph. Retrieved from http://products.sanofi.ca/en/renagel.pdf

Taksande, S.R., & Worcester, E.M. (2014). Calcium supplementation in chronic kidney disease. *Expert Opinion on Drug Safety, 13*(9), 1175–1185. doi:10.1517/14740338.2014.937421

Tomasello, S.R. (2007). Bone metabolism and disease in chronic kidney disease. *Pharmacotherapy Self-Assessment Program (PSAP),* 6th Edition, Book 2, Nephrology II (pp. 55–67). Lenexa, KS: American College of Clinical Pharmacy.

Vaiciuniene, R., Kuzminskis, V., Ziginskiene, E., Skarupskiene, I., & Bumblyte, I.A. (2011). Adherence to treatment and hospitalization risk in hemodialysis patients. *Journal of Nephrology, 25*(5), 672–678. doi:10.5301/jn.5000038

Yagil, Y., Fadem, S. Z., Kant, K.S., Bhatt, U., Sika, M., Lewis, J.B., & Negoi, D. (2015). Managing hyperphosphatemia in patients with chronic kidney disease on dialysis with ferric citrate: Latest evidence and clinical usefulness. *Therapeutic Advances in Chronic Disease, 6*(5), 252–263. doi:10.1177/2040622315589934

Zhang, C., Wen, J., Li, Z., & Fan, J. (2013). Efficacy and safety of lanthanum carbonate on chronic kidney disease–mineral and bone disorder in dialysis patients: A systematic review. *BMC Nephrology, 14*(1), 226. doi:10.1186/1471-2369-14-226

Zhu, D., Mackenzie, N.C., Farquharson, C., & Macrae, V.E. (2012). Mechanisms and clinical consequences of vascular calcification. *Frontiers in Endocrinology, 3*(95), 1–12. doi:10.3389/fendo.2012.00095

CONTINUING EDUCATION STUDY QUESTIONS **CONTACT HOUR: 2.0 HRS**

Update on phosphate binders: The old and the new

By Jacob Cashin and Marisa Battistella

1. Sustained high serum phosphate levels can cause which of the following?
   a) increased cardiovascular morbidity and mortality
   b) calcification
   c) calciphylaxis
   d) mineral bone disease
   e) all of the above

2. Which of the following is an advantage of sevelamer hydrochloride (Renagel®)?
   a) decreased pill burden
   b) relatively low cost
   c) low risk for hypercalcemia
   d) higher affinity for phosphorous
   e) all of the above

3. Angus is a 60-year-old man without private drug plan coverage who worked his entire life as a grocery store clerk. His doctor recently diagnosed him with CKD and he does not like taking a lot of pills at once. What do you recommend Angus takes to lower his phosphate levels?
   a) calcium carbonate (TUMS® Ultra)
   b) aluminum hydroxide (Amphogel®)
   c) lanthanum carbonate (Fosrenol®)
   d) sevelamer hydrochloride (Renagel®)

4. Which of the following is true with respect to aluminum hydroxide (Amphogel®)?
   a) it is a first-line agent for the treatment of hyperphosphatemia in CKD patients
   b) aluminum accumulation is a concern for CNS toxicity, worsening anemia, and constipation
   c) it requires less monitoring and is safe for long-term use
   d) it reverses bone demineralization, preventing osteomalacia

5. One of your patients, Mrs. Johnson, takes calcium carbonate 1,250 mg with each meal to help control her phosphate levels, but her serum phosphate levels have still been consistently high over the past few months. Upon further questioning, you discover she is taking it incorrectly and tell her that she should:
   a) swallow the tablet whole at the end of every meal
   b) chew the tablet once in the morning and once before bed
   c) swallow the tablet whole on an empty stomach 30 minutes before eating
   d) chew or swallow the tablet with the first bite of every meal

6. Which of the following about aluminum-based phosphate binders is true?
   a) aluminum is largely removed by dialysis, and thus higher doses are necessary to control serum phosphate levels
   b) they are safe for short-term use to control high phosphate levels
   c) they are first-line agents for treating hyperphosphatemia in dialysis patients, and are widely available in many different dosage forms
   d) chronic use may increase risk for hypercalcemia

7. Which of the following about hyperphosphatemia is true?
   a) hyperphosphatemia is a common finding in the early stages of CKD
   b) serum phosphate levels can often be controlled with dietary modifications alone
   c) phosphate is largely removed by hemodialysis, but dietary modifications and phosphate binders are often required to achieve sufficient serum phosphate control
   d) phosphate is not removed by hemodialysis and, thus, phosphate binders are needed to control serum phosphate levels

8. Which of the following medications should be administered separately (i.e., either one hour before, or two hours after) from sevelamer?
   a) doxycycline
   b) amlodipine
   c) ciprofloxacin
   d) both a and c
   e) all of the above

9. Which of the following is true regarding phosphate binders?
   a) calcium carbonate contains 20% elemental calcium
   b) lanthanum carbonate must be swallowed whole, as it is insoluble in water
   c) constipation and hypermagnesemia are common dose-limiting side effects of magnesium-based phosphate binders, and so they are not commonly used
   d) the most common side effects of ferric citrate are discoloured stools and constipation

10. Which of the following about sevelamer hydrochloride (Renagel®) is false?
    a) the tablets must be chewed in order to exert their phosphate-binding effect
    b) patients may need to take several tablets with each meal to control phosphate levels, resulting in a high pill burden
    c) the most common side effects of sevelamer hydrochloride are gastrointestinal-related, and include bloating and constipation
    d) sevelamer is an option for patients at high risk for recurrent episodes of hypercalcemia

CONTINUING EDUCATION STUDY ANSWER FORM

CE: 2.0 HRS CONTINUING EDUCATION

Update on phosphate binders: The old and the new

Volume 26, Number 1

By Jacob Cashin and Marisa Battistella

Post-test instructions:

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- Send only this answer form (or a photocopy) to:
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4.	a	b	c	d	
5.	a	b	c	d	
6.	a	b	c	d	
7.	a	b	c	d	
8.	a	b	c	d	e
9.	a	b	c	d	
10.	a	b	c	d	

EVALUATION

	Strongly disagree				Strongly agree
1. The offering met the stated objectives.	1	2	3	4	5
2. The content was related to the objectives.	1	2	3	4	5
3. This study format was effective for the content.	1	2	3	4	5
4. Minutes required to read and complete:	50	75	100	125	150

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An overview of advance care planning for patients with advanced chronic kidney disease: The basics

By Betty Ann Wasylynuk and Sara N. Davison

ABSTRACT

As the number of Canadians living with end-stage kidney disease (ESKD) continues to grow, even higher numbers are living with advanced chronic kidney disease (CKD). Many of these people will eventually require renal replacement therapy (RRT), either dialysis or transplantation. More than 50% of patients starting RRT today are aged 65 or older, with the fastest growing group being patients 75 years and older. Despite advances to dialysis technology and dialysis care, the mortality rates remain high and dialysis patients' end-of-life care may not align with their preferences or values. Advance care planning (ACP) is an essential component of quality comprehensive kidney care. Kidney care teams develop strong relationships with their patients and are well positioned to integrate ACP into routine kidney care. This article defines ACP, outlines the essential components of ACP, and discusses the benefits, challenges, and special considerations of ACP. By enhancing the kidney care team's understanding of ACP, this article aims to assist in integrating ACP into routine kidney care for patients with advanced CKD.

Nearly 42,000 Canadians were living with end-stage kidney disease (ESKD) by the end of 2013, a 35% increase from 2004 (Canadian Organ Replacement Register [CORR], 2015). Even greater numbers are living with advanced chronic kidney disease (CKD), defined here as glomerular filtration rate (GFR) category 4 and 5 CKD, and face the possibility of requiring renal replacement therapy (RRT) in the form of either dialysis or transplantation. More than 50% of patients starting RRT are aged 65 and over with the most rapidly growing group being those 75 years and older (CORR, 2015). Despite advances in dialysis technology and dialysis care, mortality rates for dialysis patients remain extremely high and their end-of-life care is characterized by high rates of hospitalization, intensive care unit (ICU) admission, and intensive procedures (Wong, Kreuter, & O'Hare, 2012) inconsistent with their preferences and values (Davison, 2010).

The unpredicted illness trajectory for patients with advanced CKD reinforces the importance that advance care planning (ACP) has as an essential component of quality comprehensive kidney care (Davison et al., 2015; Wasylynuk & Davison, 2015). It is not unusual for multidisciplinary kidney care teams (nephrologists, nurses, social workers, dietitians, and chaplains) to develop strong relationships with their patients, putting them in an excellent position to integrate ACP into routine kidney care. However, to accomplish this, kidney care teams need a full understanding of ACP. In this article, we define ACP, outline the essential components of these discussions, and discuss potential benefits, barriers/challenges, and special religious/spiritual, cultural, ethical and legal considerations of ACP. Several links to Canadian ACP resources are also provided (Table 1). By promoting a greater understanding of ACP, this article aims to assist the kidney care team in integrating ACP into routine kidney care for patients with advanced CKD.

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WHAT IS ACP?

ACP is a process of reflection, understanding, communication, and discussions between the patient, their family, and the health care (kidney care) team, whereby the patient (i) prepares for a time when they are incapable of directing their own health care, (ii) identifies a substitute decision-maker (SDM), and (iii) clarifies their health status and preferences for future and end-of-life care that align with their beliefs, values, and goals (Davison & Torgunrud, 2007; Hammes, 2001).

ACP is for all capable adults including those who are healthy, but is especially relevant for those living with chronic disease or those approaching the end of life. For patients with advanced CKD, ACP is best initiated early in the course of illness and, most importantly, before a health crisis (Health Canada, 2008). ACP should include discussions about starting, withholding, or withdrawing dialysis in the context of the patient's cultural, religious and/or spiritual beliefs (Davison et al., 2015). ACP focuses on what it means for the patient to live well and die well (Davison & Torgunrud, 2007). It is a process that ensures discussions are ongoing throughout the patient's illness, such that care plans and documentation remain aligned with the patient's prognosis and preferences for end-of-life care.

ESSENTIAL ELEMENTS OF ACP

Patient Identification and Engagement

While ACP is potentially beneficial for all CKD patients, identifying patients most likely to benefit from ACP helps prioritize and direct resources that may be limited. The majority of patients with advanced CKD journey along an unpredictable illness trajectory that is often characterized by a gradual, progressive decline in functional status punctuated by episodes of significant complications. There are triggers that can help prompt timely ACP discussions, such as the new diagnosis of a serious illness or complication (cancer, ischemic heart disease, amputation), the death of a friend/family member, the need to start dialysis, a change in dialysis modality (peritoneal dialysis to hemodialysis), a change in living situation (from home to long-term care) and other sentinel events, such as hospitalization and acute illness. Answering "No" to the surprise question, "Would you be surprised if the patient died in the next 12 months?," should prompt the kidney care team to initiate ACP discussions with the patient, if not already done. Patients who have chosen to be treated conservatively, without dialysis, deserve the opportunity for ACP, as do patients who are considering stopping dialysis. All these circumstances provide excellent opportunities to engage patients in ACP.

Because dialysis patients are at high risk for cognitive impairment, which often goes undetected (Murray et al., 2006), it is critical that ACP discussions occur early in the illness trajectory while comprehension and decision-making capacity remain intact. Patients should be engaged in ACP well before a health crisis. Sadly, during a crisis, patients may be unable to comprehend the severity of their illness and are often emotionally unable to make rational health care decisions. As a result, they may abdicate decision-making to their family and/or the health care team.

ACP is a voluntary process and patient motivation to engage in the process will vary. While many dialysis patients have thought about their end-of-life care options and are highly motivated to engage in ACP discussions with the kidney care team, some patients are not as interested, as they do not appreciate the benefits of ACP or feel it is not yet relevant to their care (Davison, 2009). Patients who are at lower risk for early death or serious health complications, such as those with minimal comorbidity and/or who are eligible for kidney transplantation, may not be motivated to participate in ACP and may be less of a priority for these discussions (Davison, Holley, & Seymour, 2010). Patients are, however, much more likely to become engaged once they understand how ACP can benefit them. This is illustrated in a study where dialysis patients identified ACP as an important part of their medical care once they understood the process and how it could benefit them personally (Davison, 2006). These patients wanted clear and honest information about their medical condition and prognosis, and what that would mean for them in the future. They wanted to know about treatment options (including dialysis withdrawal) and symptom management, and to be able to plan not only for the future, but also for the end of life (Davison 2006; Davison & Torgunrud, 2007). They realized the importance of having these discussions in a timely manner and wished to have them early in their illness trajectory, even before making the decision to start dialysis. They believed ACP discussions would help them choose medical treatments that would still allow them to achieve their personal goals for living well.

Identifying an SDM

When a patient encounters a significant complication rendering them unable to make their own health care decisions, the family is asked to make decisions for the patient. Often the family is unprepared and uninformed to make health care decisions for their loved one and, as a result, they struggle with the emotional burden wondering whether or not they made the right decisions (Holley, 2012). Part of the ACP process is having the patient choose a SDM, i.e., someone they trust to speak and make health care decisions on their behalf if they are unable. The SDM should be the person with the most knowledge of the patient's health care wishes (Lazar, Greiner, Robertson, & Singer, 1996). This does not have to be a family member. The SDM must be willing to take on this responsibility; must have conversations with the patient and understand their values, beliefs and goals; must be able to make decisions under stressful situations; and lastly, must be able to honour the patient's wishes. The patient is also encouraged to communicate their wishes for future health care to the rest of their family and loved ones. This not only ensures all family members are aware of the patient's wishes and, thus, can fully support the SDM when carrying out the patient's wishes, but also helps to avoid family conflict around end-of-life decision-making (Davison, 2012).

Identifying Treatment Preferences and Goals of Care

A central component of ACP is clear and honest discussions with patients and their SDMs about the patient's prognosis and treatment options, including expected outcomes. Patients need to understand how treatments will impact their daily lives in order to decide whether treatments will allow them to achieve their goals for living well (Davison, 2006). This includes conversations about the potential risks and benefits of dialysis for patients and the option of conservative (non-dialysis) care for those patients unlikely to benefit from dialysis. For dialysis patients, it means having discussions about health states in which they would no longer wish to continue dialysis, such as severe functional and/or cognitive impairment, and the option for dialysis withdrawal, a topic not commonly addressed in ACP (Holley et al., 1999).

Likewise, it is essential to have discussions around cardiopulmonary resuscitation (CPR), as most patients are unaware of the poor survival rates following CPR (Davison, Holley & Seymour, 2010). The six-month survival rate

following CPR is only 3%, with survivors having a high likelihood of sustained and significant physical and/or cognitive disability (Moss, Holley, & Upton, 1992). It is the kidney care team's responsibility to inform the patient of the inherent risks of CPR (fractured ribs, pain, pneumonia and prolonged ventilation and ICU stay) and possible outcomes (physical and cognitive impairment, and likely death), so patients can make an informed decision (Holley, 2012). Additionally, it is important to explore with patients other life-sustaining measures, such as feeding tubes, mechanical ventilation, and the ICU (Canadian Hospice Palliative Care Association [CHPCA], 2008). In essence, ACP discussions are not about recommending or withholding treatments; rather, they are about providing the risks and benefits of treatments and alternative care pathways so patients can make decision about care that truly align with their values and beliefs. By understanding what matters most to a given patient, the kidney care team can help recommend care that aligns with stated values and beliefs, and then develop a care plan to ensure the patient's wishes are honoured.

Finally, ACP discussions allow the patient to exercise autonomy and control, and to share with the kidney care team how they expect decisions to be made (locus of control and power) (Davison & Torgunrud, 2007). Does the patient prefer to make their decisions exclusively themselves, while they still can, or do they expect input from others (family or the kidney care team)? What roles do they want family or the kidney care team to take on?

In summary, having discussions with patients about treatment preferences and goals for care allows them to verbalize (i) what is important for them today and in the future, (ii) what makes their life meaningful, (iii) under what circumstances the burden of treatment outweighs the benefits of prolonging life, and (iv) how various care options will preserve an acceptable quality of life (CHPCA, 2012; Swidler, 2012).

Documentation

Outcomes from ACP discussions, such as determining an SDM and treatment decisions, need to be communicated to SDMs and care teams to ensure patients' wishes are honoured. This can be done by an advance care plan, such as an advance directive. An advance directive is a legal document that allows patients to document their treatment preferences and who their SDM is. It is important to note that an advance directive is invoked only when it is determined that the patient is incapable of making health care decisions. Although the completion of an advance directive is recommended, ACP can be very successful despite patients not completing an advance directive. The gift is in the conversation.

Secondly, the patient's preferences for life-sustaining therapy and medical care interventions can be translated into a medical order, such as a code status, or the Goals of Care Designation (GCD) order in Alberta, or the Medical Order for Scope of Treatment (MOST) in some parts of British Columbia. The specifics of such a medical order varies across health regions and provinces, therefore kidney care teams must be aware of the policies and procedures governing medical orders in their specific region.

Because a patient's health care wishes may change as their health condition changes, patients are encouraged to keep the channels of communication open with their SDM, their family, and the kidney care team, and update any documentation, as necessary, to ensure care plans reflect current health care wishes.

POTENTIAL BENEFITS OF ACP

ACP discussions are reported to have rippling benefits for patients, families and care teams (Wright et al., 2008). The discussions strengthen patients' understanding of their illness, prognosis, and future treatment options. ACP empowers patients and allows them to make health care decisions based on their preferences and values, increases patient satisfaction, and alleviates fears and uncertainties about what lies ahead, particularly as it relates to end-of-life care (CHPCA, 2008). ACP discussions help patients determine what medical treatments they would or would not want, including continuation of dialysis or withdrawal, should they suffer a complication leaving them in an undesirable state. Interestingly, patients who have undergone ACP are reported to have received less aggressive care, fewer ICU admissions, fewer admissions to hospital, and are more likely to die at home or in a hospice, as opposed to the hospital (CHPCA, 2012; Wright et al., 2008). Despite concerns that ACP may rob patients of hope, the information provided during an ACP discussion allows patients to determine their preferences and goals for future care, which, in turn, enhances hope. It is difficult for patients to have hope if they cannot imagine what tomorrow may bring (Davison & Simpson, 2006).

ACP discussions with family can strengthen these relationships and help to resolve misconceptions and uncertainties family may have (Davison, 2006). ACP discussions give the SDM the confidence to make appropriate health care decisions on the patient's behalf and helps avoid disputes between family members (CHPCA, 2008). The benefits of ACP extend beyond the death of a loved one. Family can be comforted knowing their loved one's wishes were carried out, eliminating regret or uncertainty. For this reason, ACP helps promote a more positive and healthy bereavement period (Wright et al., 2008).

Finally, the information shared through ACP helps build relationships between the kidney care team and the patient, their SDM, and their family. Having the kidney care team informed of the patient's health care wishes helps avoid conflict around end-of-life decisions, which can be a profound source of anguish. The care team can draw a great sense of comfort from knowing they are providing care aligned with the patient's wishes (CHPCA, 2008).

BARRIERS AND CHALLENGES OF ACP IN ADVANCED CKD

Some of the barriers to facilitating ACP are outlined in Table 2 and can involve patients, their family, and/or the kidney care team. The kidney care team has a responsibility to ensure patients understand what ACP is and how it benefits them. Integrating ACP into routine kidney care and providing patients with ACP resources and strategies on how they can safely broach these conversations with their family promote safe and comfortable dialogue between patients, family members, and the care team. For those patients who wish to have ACP discussions outside the patient-kidney care team relationship, it is vital that the care team support and respect this decision. Lastly, refraining from using medical jargon, which is known to distance the care team from the patient (Davison, 2006), is critical to ensure an open and clear dialogue between the patient and the kidney care team.

Table 1: Advance Care Planning Resources in Canada

Web Resources
Canadian Hospice Palliative Care Association http://www.chpca.net/projects-and-advocacy/projects/advance-care-planning.aspx
Dying With Dignity http://www.dyingwithdignity.ca
Speak Up http://www.advancecareplanning.ca
Virtual Hospice (search "advance care planning") http://www.virtualhospice.ca

Table 2: Barriers to Integrating ACP for Patients with Advanced CKD

Patient and Family Barriers	• Lack knowledge and understanding about treatment options at end-of-life • Are ready to have discussions with the care team, but don't know how to broach the topic, or are waiting for the care team to initiate the discussion • Are ready to have discussions with their family, but are afraid of upsetting them • Lack understanding of ACP and how it may be of benefit • Believe ACP is not relevant to them • Believe they are not terminally ill and that dialysis will keep them alive forever • Depend on their family to make decisions on their behalf and assume family will know what to do • Feel more comfortable having discussions with only their family; not with the care team • Fear of medical jargon (won't understand what the care team is saying)
(Davison, 2006; Davison & Simpson, 2006; Davison, Holley, & Seymour, 2010)	
Care Team Barriers	Nurses and allied health workers (social workers, dietitians, and chaplains): • Lack knowledge about ACP (when & how to initiate and with whom) • Lack knowledge or comfort with end-of-life decision-making • Lack knowledge about alternatives to aggressive treatment • Lack training on effective communication skills • Lack the time in having discussions • Lack support from management and physician group • Working environment is not conducive for ACP discussions (is noisy, no privacy, short-staffed, insufficient time) • Are waiting for the patient to initiate the discussion • Fear of upsetting the patient and family • Feel patients don't need or want to have ACP discussions • Feel it will destroy a patient's hope • Have conflicting beliefs and values from that of the patient's • Feel it is not their sole responsibility, but the physician's Physicians: • Lack the time in having discussions • Fear of upsetting the patient and family • Feel patients are not ready to have ACP discussions • Feel is will destroy a patient's hope • Lack ACP training and communication skills
(Ceccarelli, Castner, & Haras, 2008; Combs et al., 2015; Davison, 2010; Haras, Astroth, Woith, & Kossman, 2015; Yee, Seow, Tan, Goh, & Lee, 2011)	

Many of the kidney care team barriers reflect inadequate knowledge of and training in ACP and how to have these conversations (Combs et al., 2015). Dialysis units also have not traditionally been structured to support ACP where current models of care focus primarily on attaining laboratory targets and clinical parameters to prolong survival, rather than talking with patients about what matters most to them. Providing the kidney care team with ACP education and resources (some of which are outlined in Table 2), competency-based communication skills training, and a mentoring program that supports all staff will be important in overcoming these barriers. Specifically for the nurses and allied health workers, it is vital that they receive coordinated support from their managers and physician group.

THE RELIGIOUS, SPIRITUAL AND CULTURAL CONSIDERATIONS OF ACP

Death is not just a medical event; it is a personal, religious, and/or spiritual event that deserves special consideration in ACP discussions (Watson, 2011). ACP offers the patient the opportunity to reflect on and express their religious or spiritual beliefs so that the advance care plan is sensitive to and supports the patient's expressed religious or spiritual beliefs (Watson, 2011). As our country continues to diversify, it is critical that the kidney care team has knowledge of a patient's culture and is aware of how their culture may influence ACP discussions. Although it would be inappropriate to assume that the patient's religion or culture automatically determines their beliefs, values, and goals for future and end-of-life care, cultural variations in the concepts of autonomy, decision-making authority, communication of prognosis, and attitudes around end-of-life care must be explored with the patient and their family to ensure care plans are culturally sensitive in all aspects (Davison, Holley, & Seymour, 2010; Respecting Choices®, 2007).

Members of the care team may also have religious/spiritual and cultural beliefs that impact their ACP discussions with patients. It is important that care providers are aware of their own values, beliefs, and biases, and how these can potentially influence the patient-care provider interaction. Awareness of these differences in beliefs is necessary to create a dialogue with the patient that is respectful and nonbiased.

THE ETHICAL AND LEGAL CONSIDERATIONS OF ACP IN CANADA

ACP is governed by the ethical principle of autonomy and the legal doctrine of consent (Singer, Robertson, & Roy, 1996). The principle of autonomy, also referred to as self-determination, recognizes that all capable adults have the right to accept or refuse medical treatment (CHPCA, 2012; Canadian Nurses Association, 2008). Capable adults also have the right to express their wishes directing future medical care, verbally or in writing (i.e., advance directive) (CHPCA, 2012). ACP helps to ensure that when a patient is no longer capable of directing their care, their prior expressed verbal or written wishes are respected. Thus, ACP also hinges on the doctrine of respect for the person and their dignity (Singer et al., 1996).

The law in Canada allows all capable adults to make an advance directive. Because the legislation around advance directives varies across the country, members of the care team must become familiar with their provincial/territorial legislation around advance directives (CHPCA, 2012). For example, the advance directive and SDM are referred to by different names, depending on the province.

SUMMARY

The illness trajectory for patients with advanced CKD is unpredictable. As such, having patients start planning for future health care in the event they become incapable of directing their own health care early in their illness trajectory is paramount. ACP is a process that ensures that the patient's voice is heard throughout their illness trajectory, and that advance care plans documenting the patient's wishes (advance directives, medical orders) are continually updated to reflect the patient's current wishes. This ensures that all care remains concordant with patients' preferences, even if they become incapable of speaking for themselves. Despite the challenges and special considerations surrounding ACP for patients with advanced CKD, ACP is noted to have substantial benefits for the patients, families, and kidney care teams, and is considered an integral component of quality kidney supportive care that improves the lives of patients with advanced CKD, as well as their end-of-life care and, ultimately, their deaths.

REFERENCES

Canadian Organ Replacement Register (2015, April 21). *Canadian Organ Replacement Register annual report: Treatment of end-stage organ failure in Canadians 2004-2013.* Retrieved from https://secure.cihi.ca/free_products/2015_CORR_AnnualReport_ENweb.pdf

Canadian Hospice Palliative Care Association (2008). *Educating future physicians in palliative and end-of-life care. Facilitating advance care planning: An interprofessional educational program: Curriculum materials.* Ottawa, ON.

Canadian Hospice Palliative Care Association (2012). *Advance care planning in Canada: National framework.* Ottawa, ON.

Canadian Nurses Association (2008). *Code of ethics for registered nurses.* Ottawa, ON: Author.

Ceccarelli, C.M., Castner, D., & Haras, M.S. (2008). Advance care planning for patients with chronic kidney disease – why aren't nurses more involved? *Nephrology Nursing Journal, 35*(6), 553–557.

Combs, S.A., Culp, S., Matlock, D.D., Kutner, J.S., Holley, J.L., & Moss, A.H. (2015). Update on end-of-life care training during nephrology fellowship: A cross-sectional national survey of fellows. *American Journal of Kidney Diseases, 65*(2), 233–239.

Davison, S.N. (2006). Facilitating advance care planning for patients with end-stage renal disease: The patient perspective. *Clinical Journal of the American Society of Nephrology, 1*(5), 1023–1028.

Davison, S.N. (2009). Advance care planning in patients with end stage renal disease. *Progress in Palliative Care, 17*(4), 170–178.

Davison, S.N. (2010). End-of-life care preferences and needs: Perceptions of patients with chronic kidney disease. *Clinical Journal of the American Society of Nephrology, 5*(2),195–204.

Davison, S.N. (2012). Advance care planning in patients with chronic kidney disease. *Seminars in Dialysis, 25*(6), 657–663.

Davison, S.N., & Simpson, C. (2006). Hope and advance care planning in patients with end stage renal disease: Qualitative interview study. *British Medical Journal,* 1–5.

Davison, S.N., & Torgunrud, C. (2007). The creation of an advance care planning process for patients with ESRD. *American Journal of Kidney Diseases, 49*(1), 27–36.

Davison, S.N., Holley, J.L., & Seymour, J. (2010). Advance care planning in patients with end-stage renal disease. In E.J. Chambers, E.A. Brown & M.J. Germain (Eds.), *Supportive care for the renal patient* (2nd ed., pp. 49–74). New York, NY: Oxford University Press Inc.

Davison, S.N., Levin, A., Moss, A.H., Jha, V., Brown, E.A., Brennan, F., … Obrador, G.T. (2015). Executive summary of the KDIGO controversies conference on supportive care in chronic kidney disease: Developing a roadmap to improving quality care. *Kidney International, 88,* 447–459.

Hammes, B.J. (2001). What does it take to help adults successfully plan for future medical decisions? *Journal of Palliative Medicine, 4*(4), 453–456.

Haras, M.S., Astroth, K.S., Woith, W.L., & Kossman, S.P. (2015). Exploring advance care planning from the nephrology nurse perspective: A literature review. *Nephrology Nursing Journal, 42*(1), 23–35.

Health Canada. (2008, March). *Implementation guide to advance care planning in Canada: A case study of two health authorities.* Retrieved from http://www.hc-sc.gc.ca/hcs-sss/pubs/palliat/2008-acp-guide-pps/index-eng.php

Holley, J.L. (2012). Advance care planning in CKD/ESRD: An evolving process. *Clinical Journal of the American Society of Nephrology, 7,* 1033–1038.

Holley, J.L., Hines, S.C., Glover, J.J., Babrow, A.S., Badzek, L.A., & Moss, A.H. (1999). Failure of advance care planning to elicit patients' preferences for withdrawal from dialysis. *American Journal of Kidney Disease, 33*(4), 688–693.

Lazar, N.M., Greiner, G.G., Robertson, G., & Singer, P.A. (1996). Bioethics for clinicians: 5. Substitute decision-making. *Canadian Medical Association, 155*(10), 1435–1437.

Murray, A.M., Tupper, D.E., Knopman, D.S., Gilbertson, D.T., Pederson, S.L., Li, S., … Kane, R.L. (2006). Cognitive impairment in hemodialysis patients is common. *Neurology, 67,* 216–223.

Moss, A.H., Holley, J.L., & Upton, M.B. (1992). Outcomes of cardiopulmonary resuscitation in dialysis patients. *Journal of the American Society of Nephrology, 3*(6), 1238–1243.

Respecting Choices®. (2007). *Respecting Choices® advance care planning facilitator course.* La Crosse, WI: Gundersen Lutheran Medical Foundation.

Singer, P.A., Robertson, G., & Roy, D.J. (1996). Bioethics for clinicians: 6. Advance care planning. *Canadian Medical Association, 155*(12), 1689–1692.

Swidler, M.A. (2012). Geriatric renal palliative care. *The Journals of Gerontology. Series A, Biological Sciences and Medical Sciences, 67*(12), 1400–1409.

Wasylynuk, B.A., & Davison, S.N. (2015). Palliative care in patients with advanced chronic kidney disease. *Canadian Association of Nephrology Nurses and Technologists Journal, 25*(3), 28–32.

Watson, M. (2011). Spiritual aspects of advance care planning. In K. Thomas & B. Lobo (Eds.), *Advance care planning in end of life* (pp. 45–54). New York, NY: Oxford University Press Inc.

Wong, S.P., Kreuter, W., & O'Hare, A.M. (2012). Treatment intensity at the end of life in older adults receiving long-term dialysis. *Archives of Internal Medicine, 172*(8), 661–663.

Wright, A.A., Zhang, B., Ray, A., Mack, J.W., Trice, E., Balboni, T. … Prigerson, H.G. (2008). Associations between end-of-life discussions, patient mental health, medical care near death, and caregiver bereavement adjustment. *Journal of the American Medical Association, 300*(14), 1665–73.

Yee, A., Seow, Y.Y., Tan, S.H., Goh, C., & Lee, G. (2011). What do renal health-care professionals in Singapore think of advance care planning for patients with end-stage renal disease? *Asian Pacific Society of Nephrology, 16*(2), 232–238.

Water—The first ingredient of the dialysis prescription

By José Lloyd

EXPOSURE TO WATER DURING HEMODIALYSIS

What is the deal with all that water treatment equipment? Why do we need all the pre-treatment, just to do dialysis at home? To understand fully the need for extensive water treatment equipment, one must consider the following: It is estimated that the water intake of a healthy individual is approximately 2 L per day or 14 L per week. By comparison, during a single dialysis treatment lasting four hours, performed at a dialysate flow rate of 500 mL/min, a hemodialysis patient is exposed to 120 L of water per treatment, or up to 360L per week, if treated three times weekly. Hemodialysis patients have inadequate barriers to water-borne contaminants. In healthy individuals not on dialysis, the gastrointestinal tract separates blood from contaminants in the water. By comparison, the barrier between blood and water in hemodialysis patients is the membrane within the hemodialyzer through which the transfer of contaminants is limited only by the size of the contaminant. Exposure to water contaminants can have several adverse effects (Table 1).

ENSURING SAFE QUALITY WATER

Now that we are aware of the potential contaminants and their adverse effects on the hemodialysis population, how does one ensure the best possible water for our dialysis patients?

It all begins with potable water. It is easier than ever to retrieve data on local water treatment facilities. However, subtleties in water chemistry caused by proximity to the municipal water supply and infrastructure, as well as due diligence, have led many dialysis facilities to have third party water testing done. Along with water chemistry, the calculated volume required by the system is necessary to establish an adequate water treatment plan. Consideration of the size of the dialysis unit, room for some expansion, and all points of use that the water treatment will support need to be recognized.

Pipe sizing, material composition, and capacity are all important factors in the initial phases of planning. Another matter that needs consideration is tempering of the water. Generally speaking, dialysis water systems in Canada are equipped with a blend valve, as water temperature can impact membrane performance of the Reverse Osmosis (RO) Unit. Too cold and the membrane will constrict, thus decreasing the volume of water produced. Too warm and the membrane will expand, thereby allowing greater passage of solutes and decreasing the per cent rejection rate. The optimal temperature for membrane performance for the purpose of dialysis is 15 to 20°C. Maintaining adequate pressure is essential for the performance of many of the components downstream in the water treatment systems. Therefore, a booster pump is often required. There are some innovations in this area to date that may assist in increasing the longevity of components. A conventional booster pump maintains a specific pressure in a static fashion; the pump boosts the pressure by a specific amount regardless of incoming pressure. Most dialysis treatments occur in hospital settings. A hospital-based dialysis unit receives its feed water from a main water line that also supports other areas of the hospital, which can cause variations on water pressure when demand is high at peak times of the day. Thus, an increase in fluctuations of the incoming water pressure can

Table 1: Signs and Symptoms of Possible Water Contaminant-Related Cause

Sign or Symptom	Possible Water Contaminant-Related Cause
Anemia	Aluminium, Chloramines, Copper, Zinc
Bone disease	Aluminium, Fluoride
Hemolysis	Chloramines, Copper, Nitrates
Hypertension	Calcium, Sodium
Hypotension	Bacteria, Endotoxin, Nitrates
Metabolic acidosis	Low pH, Sulphates
Muscle weakness	Bacteria, Calcium, Copper, Endotoxin, Low pH
Nausea and vomiting	Magnesium, Nitrates, Sulfates, Zinc
Neurological deterioration and encephalopathy	Aluminium

Food and Drug Administration (1989)

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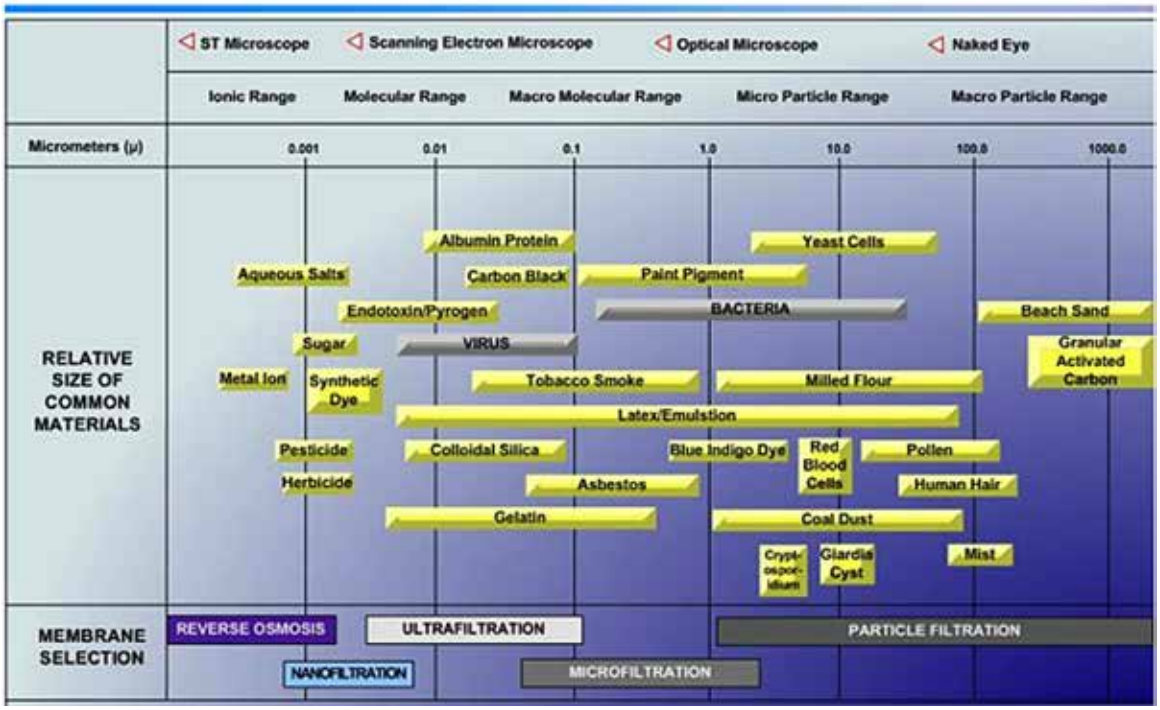

Figure 1: Filtration Spectrum Chart
Ultrapure (2016). Reprinted with permission.

occur at any given time. The solution is a booster pump with the ability to be set to the desired system pressure, e.g., 80 psi, which the pump would then maintain in a dynamic fashion, increasing or decreasing as necessary. Once proper pressure has been determined, the next step is to begin the purification process. This process can be broken down into three basic techniques used in various combinations that make up the pre-treatment of water: filtration, adsorption and ion exchange. Surface filtration occurs in two areas of the pre-treatment set-up. The first area is at the beginning of the feed line where it utilizes the principle of size exclusion (FDA, 1989). Many units use dual density filters—a common size used ranges from a 50-micron to a 5-micron filter. These filters are replaced regularly in order to maintain the pressure of the system. Similar filters are used just prior to the inlet of the RO. This removes smaller particles that may be introduced to the system from the carbon filter media along with added protection of the RO membrane. Single or dual density filter can be used and a typical pore size is 1 micron. Figure 1 illustrates the size of common materials and the related purification strategy.

As noted in Table 1, magnesium and calcium are two elements that can cause adverse effects not only to the dialysis population, but will also foul the RO membrane, thus decreasing its performance. The method used for the removal of hard water elements is ion exchange. Polystyrene resin has a negative charge—it is then 'loaded' with sodium via a super saturated solution referred to as brine in the regeneration process of a water softener. Calcium and magnesium in water both carry positive charges. This means these minerals will cling to the resin beads, as the hard water passes through the mineral tank.

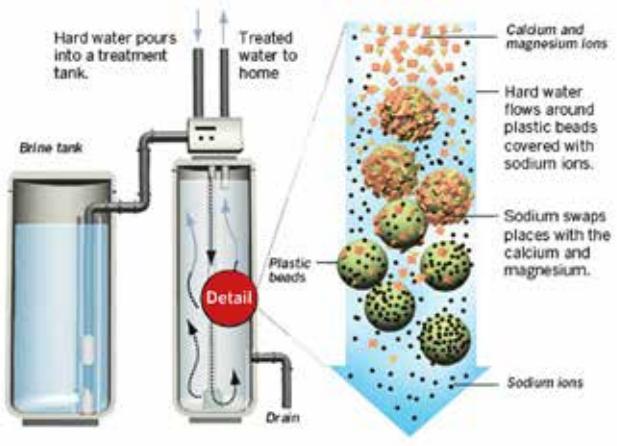

Figure 2: Water softener
Rite Boiler (2012). Reprinted with permission.

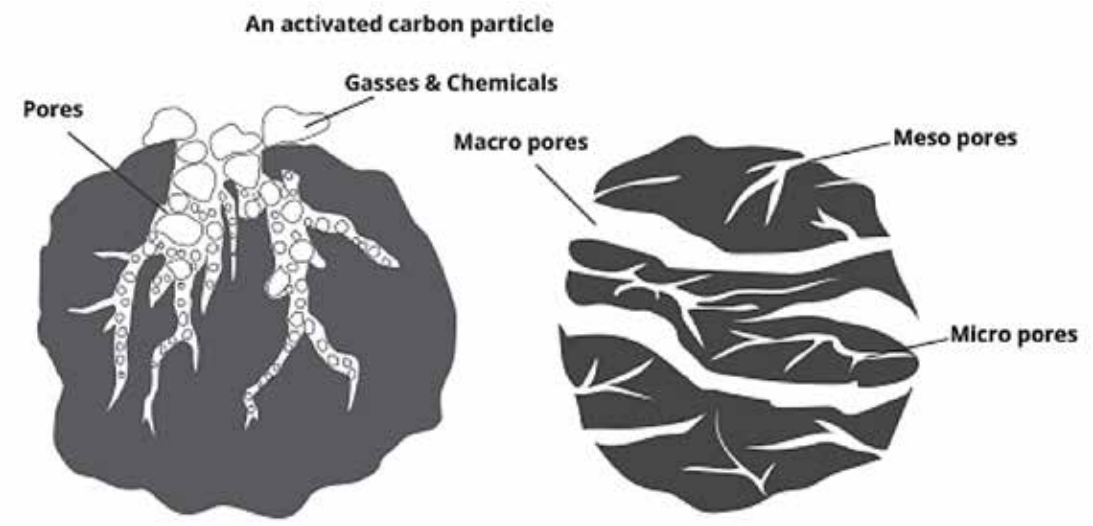

Figure 3: Granular activated carbon
Aquacache (n.d.). Reprinted with permission.

Sodium ions also have positive charges, albeit not as strong as the charge on the calcium and magnesium. Therefore, it moves into the feed water. When a very strong brine solution is flushed through a tank that has beads already saturated with calcium and magnesium, the sheer volume of the sodium ions is enough to drive the calcium and magnesium ions off the beads. Water softeners have a separate brine tank that uses common salt to create this brine solution (Figure 2).

ORGANIC SCAVENGER TECHNOLOGY

An interesting addition to the dialysis water treatment systems that is gaining popularity is the organic scavenger technology. The combined effects of high chlorine and chloramine levels and naturally occurring total organic carbon (TOC) levels found in municipal feed water have been found to decrease the life of carbon media used in the application of water purification of water for dialysis. While the scavenger technology has been in use since 1997 in other settings, such as drinking water processes, it has recently been introduced into the dialysis setting. It works on the principle of ion exchange, i.e., instead of being "loaded" with sodium, as it is with the softener, it is "loaded" with chloride ions. Water testing is required to ensure that the need for an organic scavenger is indicated. In addition to removing organic matter, the scavenger technology can actually reduce the amount of chlorine and chloramine levels in the system, thus reducing the strain on the purification processes further downstream.

CARBON FILTERS

The next component of the pre-treatment is typically carbon media/filter. Its primary function is to remove chlorine and chloramines from the feed water by way of physical adsorption along with some catalytic activity. Municipalities are choosing chloramine as a disinfectant alternative to chlorine, which is a combination of chlorine and ammonia. Chloramine is more stable and does not create disinfectant by-products. Activated carbon (Figure 4) has a limited capacity to remove chloramines to enhance the catalytic activity of carbon, a chemical process in which the electronic structure of the carbon is altered in such a manner that the resulting carbon offers enhanced catalytic capability (Guar, 2013). Catalytically active sites (C*) on the activated carbon decompose chloramine molecules into a carbon oxide intermediate (CO*), which further decomposes the molecules to chloride (Guar, 2013). To illustrate, see the two-step process below:

1. $NH_2Cl + H_2O + C^* \rightarrow NH_3 + H^+ + Cl^- + CO^*$
2. $NH_2Cl + CO^* \rightarrow N_2 + 2H^+ + 2Cl^- + H_2O + C^*$

Chlorine and chloramines are monitored closely in the dialysis setting. Not only can chlorine cause hemolysis in the dialysis patient, it cannot be removed by the RO unit. Online or continuous monitoring is also growing in popularity. This method of monitoring is very useful in satellite dialysis settings where a dialysis technologist may be hours away.

GRANULAR ACTIVATED CARBON

Granular activated carbon (GAC) has three different-sized pores that all trap different-sized chemicals. Macropores have a radius greater than 25 nm, mesopores have a radius between 1 and 25 nm, micropores have a radius less than 1 nm, and sub-micropores have a radius less than 0.4 nm (Figure 3).

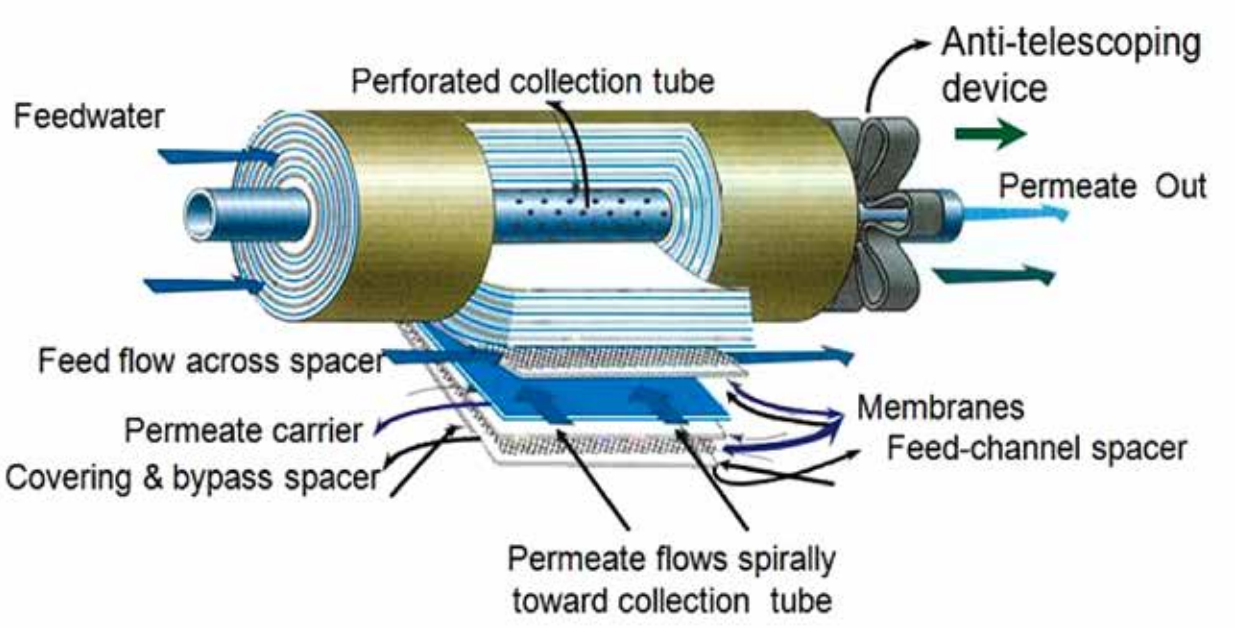

Figure 4: Spiral wound reverse osmosis membrane
Institute of Validation Technology (2015). Reprinted with permission.

REVERSE OSMOSIS

The reverse osmosis unit is the next step, which further purifies the pre-treated water so that it may be used in the dialysis prescription. The feed water freely passes through a membrane that rejects the passage of solutes. The most commonly used are spiral-wound thin film composite membranes (Figure 4). They are the most dynamic, efficient, and tolerant and, therefore, are quite effective in the production of pure water for dialysis. After the RO, there are often ultra-filters.

TESTING: THE FINAL STAGE

The final stage is to ensure that the water is meeting or exceeding the standard. It is the responsibility of each facility to ensure that CSA standards are either met or exceeded. Once the water has been tested and its composition verified, it is ready to be the first ingredient in the dialysis prescription.

REFERENCES

Aquacache (n.d.). *Aquastream modular filter arrays*. Retrieved from http://aqua-cache.com/components/wpu

Food and Drug Administration (1989). *A manual on water treatment for hemodialysis*. Rockville, MD: US Department of Health and Human Service.

Guar, V. (2013). *Water quality products*. Retrieved from http://www.wqpmag.com/catalytic-carbon-chloramine-removal

Institute of Validation Technology (2015). *Water systems images*. Retrieved from www.ivtnetwork.com

Rite Boiler (2012). *Water softener.* Retrieved from: http://www.riteboiler.com/water-softeners.php

Ultrapure (2016). *Filtration spectrum chart*. Retrieved from: www.ultrapure.com

Making home-made phantom models for hemodialysis ultrasound vascular access assessment and real-time guided cannulation training

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Ultrasound use for assessment and guided needle insertions of hemodialysis (HD) vascular access is the standard of practice in many Canadian HD units, and its use is becoming widespread around the world (Schoch, Du Toit, Marticorena, & Sinclair, 2015). Ultrasound operation requires specialized training. Skill acquisition with simulation models prior to application in clinical practice is recommended at all levels of ultrasound nursing competencies (Marticorena et al., 2015). Simulation models made of chicken breast (Rippey, Blanco, & Carr, 2015), tofu (Pollard, 2012), or phantom models made of gelatin/psyllium powder mixture (Kendall & Faragher, 2007) have been described in the literature for training in block anaesthesia and central venous catheter insertions. The model described by Kendall and Faragher (2007) was adapted to simulate a wide variety of vascular access scenarios to assist nursing staff in ultrasound training for assessment and cannulation of HD vascular access. The phantoms are made using party balloons of cylindrical shape filled with salty water and by embedding them in a preparation made of gelatin, psyllium, and salt. By adding food colouring, the mixture is obscured and hides the balloons from the naked eye, making them visible under ultrasound.

This article outlines the step-by-step instructions for making HD vascular access phantoms that can simulate images of HD access anatomical scenarios observed under ultrasound. The ingredients and supplies required to create the phantom models are presented in Table 1.

METHODS

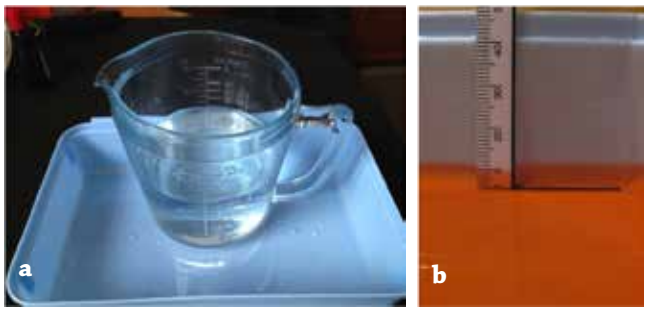
Hemodialysis vascular access depth, diameter, length, shape, and direction can be simulated as follows:

Access Depth

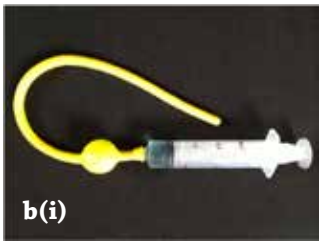
Measure the height of the container and measure the volume of water that is needed to reach the depth desired, i.e., 0.5 cm, 1.0 cm, 1.5 cm, etc. To become familiar with the preparation process, start with a volume of mixture of 250 cc to 500 cc; the recipe is calculated for a volume of 250 cc of water (Figures 1a and 1b).

Table 1: Ingredients and Supplies

Quantity	Ingredients
1 litre	Tap water (4 cups, 250 cc each)
20 g or 3 packets	Clear, flavourless, and sugarless gelatin per cup or 250 cc (can be obtained in bulk stores)
1 tablespoon	Sugarless orange-flavour psyllium powder (Metamucil, Exact, or any other similar product) per cup
1	Bottle of blue food colouring (1–2 squirts per cup)
1	Tablespoon of refined salt per cup
1	Bottle of cooking oil spray (optional)
	Supplies
1	Cooking pot
1	Plastic anti-stick tray or glass Pyrex container 22 cm long, 15 cm wide, 5 cm deep
5–6	Long party balloons per tray (depending on the size of your tray)
1	20 or 30 cc syringe
1	Strainer
1	Measuring cup
1	Tablespoon
1	Aluminum foil sheet or plastic wrap per tray



Figures 1a: Measuring cup – use increments of 250 cc.
Figure 1b: For this particular container, a volume of 250 cc is needed to obtain a depth of 10 mm (black arrow).



Figures 2a, 2b(i), and 2b(ii)

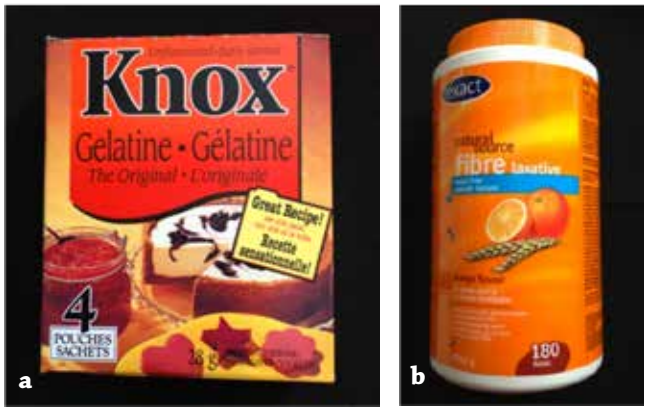
Figure 2c: Top left tray: basic competency level; top right tray: intermediate competency level; bottom tray: advanced competency level

Access Diameter, Length, Shape, and Direction Simulation

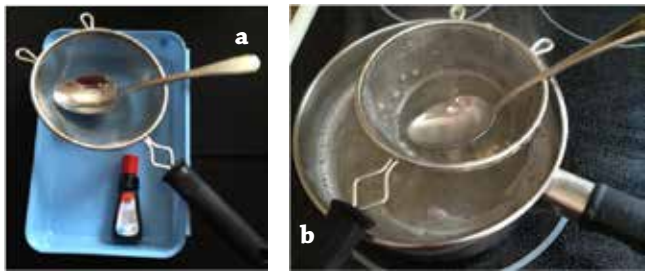
To produce normal and aneurysmal vessels, the balloons need to be inflated with salty water (to prevent fungal growth) using a syringe. It takes about 12 cc to 15 cc of water to fill up a balloon. A bulging area ("aneurysm") develops when the balloon is filled up beyond its capability to maintain its cylindrical shape (Figures 2a, 2b(i), and 2b(ii). Remove the air from the balloon before making the knot. Balloons can be knotted in different areas and be placed in a variety of directions to simulate normal to complex accesses that can assist in development of basic, intermediate, and advanced competency levels of ultrasound use (Figure 2c).

Anatomical structures surrounding vessels are obtained with the gelatin, psyllium, and salt mixture (Figures 3a and 3b). This produces contrast necessary to simulate ultrasound images of the skin and tissues surrounding blood vessels. Prepare the gelatin by heating a pot of water to a boiling point. Remove the pot from the heat and immediately pour in the gelatin powder while stirring it to minimize lump formation. Using a strainer and a spoon in this step can help dissolve the lumps (Figures 4a and 4b).

Add the psyllium powder, salt, and food colouring into the mixture and dissolve or remove the lumps (Figures 5a, 5b, and 5c).



Figures 3a and 3b



Figures 4a and 4b

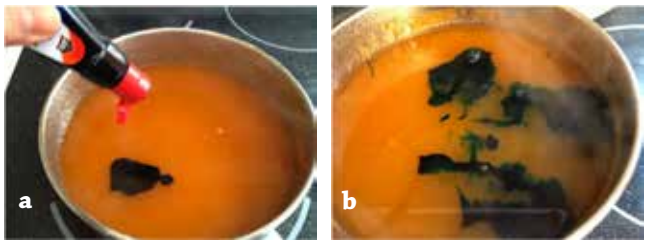
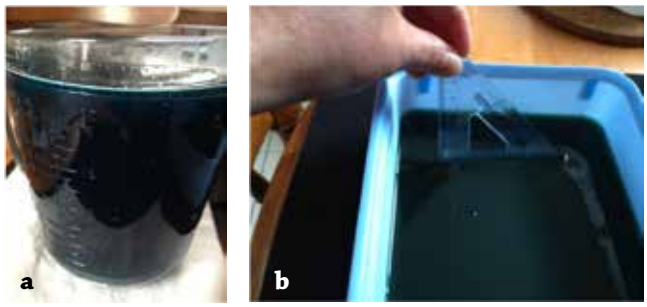


Figure 5a, 5b, and 5c



Figures 6a and 6b

PHANTOM MODEL

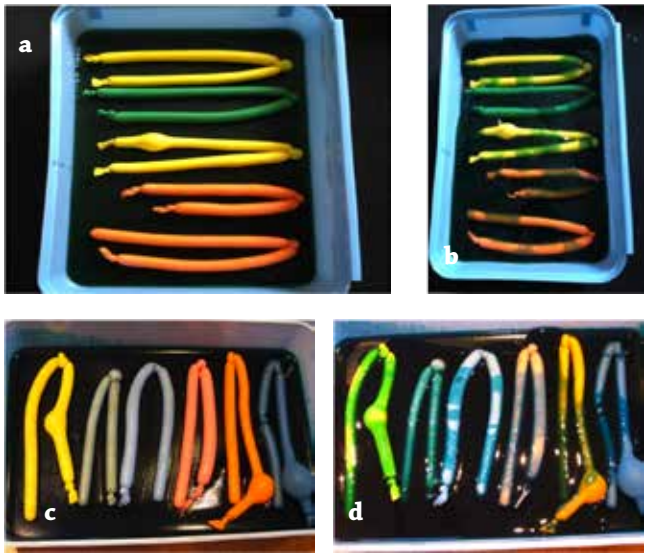
The Phantom is created in three steps (i.e., three layers of mixture).

1. Using the measuring cup, pour the required amount of mixture into the tray to obtain the depth desired (0.5 cm, 0.75 cm, 1 cm, 1.25 cm, etc.) (Figures 6a and 6b). It takes about five to 10 minutes in a freezer or about 20 minutes in a fridge to congeal the mixture. Once congealed, the balloons can be placed in an arrangement appropriate to the level of competency intended for practice (Figure 2c).
2. Once the balloons have been arranged, pour some of the mixture into the tray to fill the spaces around and between the balloons, but do not cover them completely. The balloons are meant to still be visible at this stage. This step ensures the balloons are held in place (Figures 7a, 7b, 7c, and 7d). Note: The mixture needs to be cooled down before placement of the balloons. If it is still too hot, it will melt the congealed surface and the balloons will float, losing the intended arrangement. Return the trays to the fridge for cooling; the mixture will congeal around the balloons, holding them in place.
3. Depending on the size of the tray chosen, you may have to make more mixture following the recipe outlined above to be able to pour enough mixture to now completely cover the balloons until they are no longer visible. Very large aneurysmal sites might not be able to be covered completely (Figure 8). The trays are placed back in the fridge to be congealed. Once the mixture is set, the phantom can be removed easily by dislodging the edges from the tray first. Flipping the phantom bottom up will show the surface where the balloons are only visible under ultrasound (Figures 9a, 9b, and 9c).

If the trays are not used within a few days, they need to be placed in the freezer to prevent decomposition and can be stacked with a sheet of aluminum or plastic wrap in between to prevent damage to the surface, thus saving storage space (Figure 10). When frozen, they need to be placed overnight at room temperature to allow enough thawing time to be ready for early morning practice.

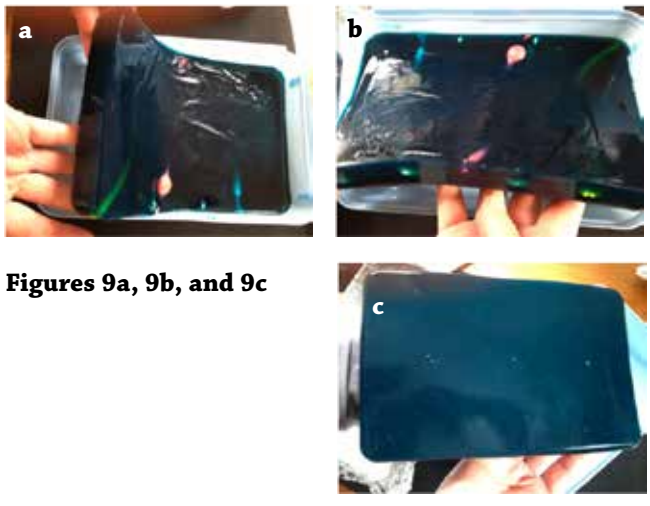
RESULTS AND CONCLUSION

This recipe has been used and continues to be used by access coordinators and educators in provincial and national HD ultrasound educational workshops due to its ability to produce phantoms that can simulate ultrasound images of a variety of HD access scenarios. Such scenarios include: (a) blood vessels and surrounding tissues (Figures 11a, 11b, 11c, and 11d), (b) prosthetic arteriovenous grafts (Figures 12a, 12b, 12c, and 12d), (c) needle placement inside the vessel lumen (Figures 13a and 13b), (d) aneurysmal and stenotic areas (Figures 14a, 14b, 14c, and 14d), and (e) thrombus formation inside the vessel lumen (Figures 15a and 15b). Use of phantom simulation models has multiple advantages (and disadvantages) (Table 2). Ultrasound practice in phantom models prior to its use in the clinical setting is recommended to obtain the hand-eye coordination required for real-time guided cannulation prior to its use in the clinical setting.



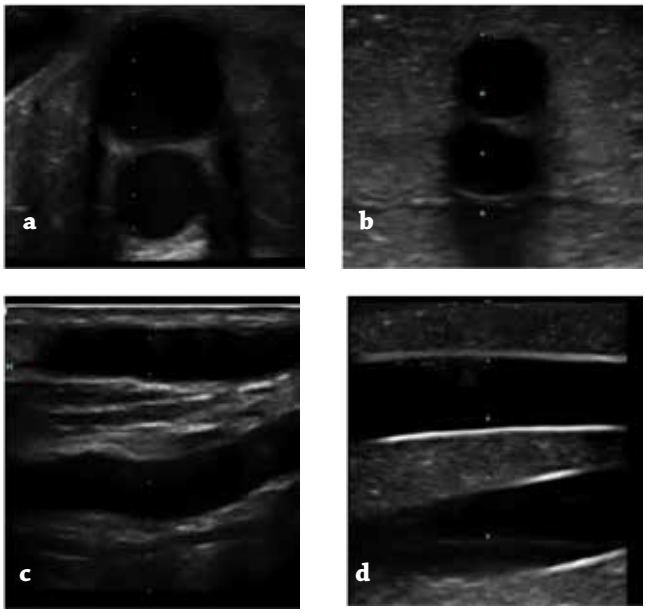
Figures 7a, 7b, 7c, and 7d

Figure 8

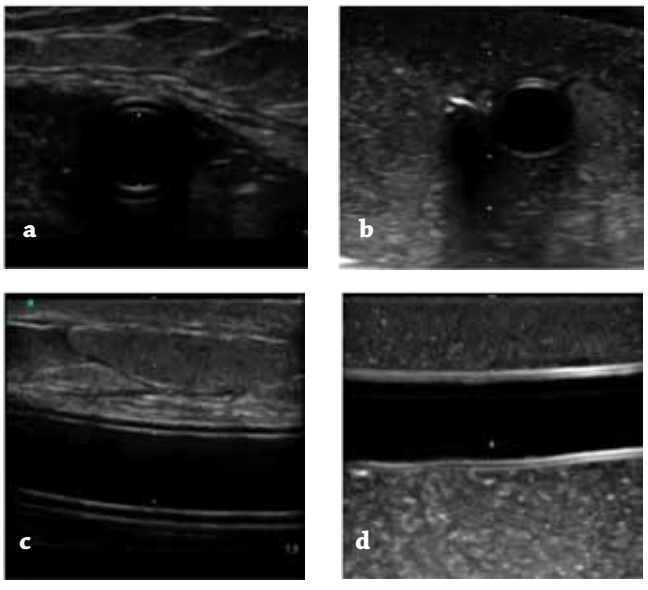


Figures 9a, 9b, and 9c

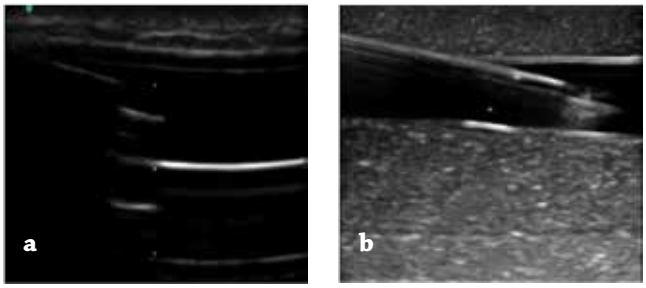
Figure 10



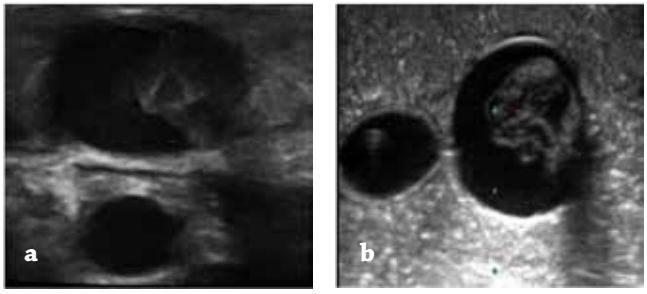
Figures 11a, 11b,11c, and 11d: Blood vessels and surrounding tissues. Short-axis view of clinical ultrasound image (11a) and phantom simulation image (11b). Long-axis view of clinical ultrasound image (11c) and phantom simulation image (11d).



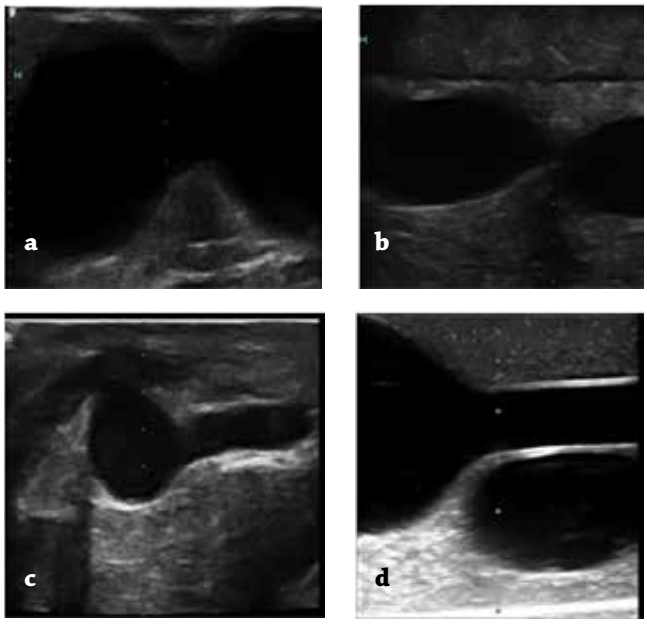
Figures 12a, 12b, 12c, and 12d: Prosthetic AV graft Short-axis view of clinical ultrasound image (12a) and phantom simulation image (12b). Long-axis view of clinical ultrasound image (12c) and phantom simulation image (12d).



Figures 13a and 13b: Needle placement inside vessel lumen. Long-axis view of clinical ultrasound image (13a) and phantom simulation image (13b).



Figures 15a and 15b: Thrombus formation inside vessel lumen. Clinical ultrasound image (15a). Phantom simulation image (15b).



Figures 14a, 14b, 14c, and 14d: Aneurysmal and stenotic areas. Short-axis view of clinical ultrasound image (14a) and phantom ultrasound image (14b). Long-axis view of clinical ultrasound image (14c) and phantom simulation image (14d).

Table 2: Advantages and Disadvantages

Advantages	Disadvantages
• Can recreate a variety of vascular access scenarios • Can be prepared ahead of time and kept frozen • Defrost overnight at room temperature. • Can use metal needles or plastic cannulae of different calibres and lengths • Low cost	• Time consuming (Approx 6 hrs to make 5 trays of phantoms) • Need to be used within a couple of days if kept in the fridge • Need to be disposed after multiple punctures • Need to be handled with gloves (due to sensitivity to latex or other ingredients)

REFERENCES

Kendall, J.L., & Faragher, J.P. (2007). Ultrasound-guided central venous access: A homemade phantom for simulation. *Canadian Journal of Emergency Medicine, 9*(5), 371–373.

Marticorena, R.M., Mills, L., Sutherland, K., McBride, N., Keys, C., Kumar, L...Donnelly, S. (2015). Development of competencies for the use of bedside ultrasound for assessment and cannulation of hemodialysis vascular access. *Canadian Association of Nephrology Nurses and Technologist Journal, 25*(4), 28–32.

Pollard, B. A. (2012). *Ultrasound Imaging for Vascular Access and Regional Anesthesia*. Retrieved from: http://info.bkultrasound.com/anesthesia-ultrasound-ebook-download

Rippey, J.C., Blanco, P., & Carr, P.J. (2015). An affordable and easily constructed model for training in ultrasound-guided vascular access. *Journal of Vascular Access, 16*(5), 422–427. doi:10.5301/jva.5000384

Schoch, M., Du Toit, D., Marticorena, R.M., & Sinclair, P.M. (2015). Utilising point of care ultrasound for vascular access in haemodialysis. *Renal Society of Australasia Journal, 11*(2), 78–82.

Fatigue in chronic kidney disease: Definition, assessment and treatment

By Dora Zalai and Miqdad Bohra

ABSTRACT

Chronic fatigue—an overwhelming subjective feeling of mental or physical exhaustion—impacts patients' everyday functioning and quality of life, delays recovery after hemodialysis, and increases mortality. There are a number of factors that may perpetuate clinically significant fatigue among individuals with chronic kidney disease, including sleep disorders, depression, sedentary lifestyle, anemia, and chronic inflammation. Some of these factors (i.e., anemia and inflammation) are in the forefront of clinical attention, whereas the other contributing factors often remain unrecognized. This article provides a pragmatic overview of the definition, assessment, maintaining factors, and management of fatigue in chronic kidney disease. Given that chronic fatigue is a major determinant of patients' quality of life, nurses can bring about a fundamental improvement in patients' well-being if they recognize the most common fatigue-perpetuating factors and facilitate fatigue management interventions.

Fatigue is a normal phenomenon that may manifest as objectively decreased muscle strength or declining cognitive performance after intense or sustained physical or mental tasks (Boksem & Tops, 2008). Experienced (also known as subjective or psychological) fatigue, however, is often independent of objectively measured muscle or cognitive fatigue. It is comprised of the physical sensations of "tiredness," the emotions associated with it, and the coping behaviours manifested in response to it. From a nursing perspective, the construct of interest is the subjectively experienced fatigue that patients describe as a feeling of physical or mental exhaustion, lack of energy, or whole-body weakness. Within this category, a chronic kidney disease (CKD)-specific fatigue phenomenon is "post-hemodialysis fatigue", namely, an amplified feeling of fatigue experienced after dialysis. It should be noted that fatigue is different from excessive sleepiness, which refers to the increased propensity to fall asleep during the day (Shen, Barbera, & Shapiro, 2006). Differentiating between sleepiness and fatigue is important because these distinct phenomena may signal different underlying causes and necessitate distinct clinical interventions.

Fatigue impacts both objective and subjective CKD outcomes. For example, declining vitality over the first year of dialysis is associated with an increased risk of death (hazard ratio = 1.4) after controlling for demographic variables, dialysis modality, creatinine, inflammatory markers, use of antidepressants, and body mass index (BMI) (Jhamb et al., 2009). Furthermore, post-dialysis fatigue is associated with delayed recovery after hemodialysis and indirectly predicts long-term survival (Kutner, Brogan, & Fielding, 1997). From a patient-centred perspective, the clinical significance of fatigue is determined by: (a) its chronicity (i.e., patients' perception that fatigue is present constantly or recurring frequently, despite attempts to alleviate it), and (b) the perceived functional impact of feeling tiredness. Ultimately, it is not the feeling of fatigue per se, but the act of forgoing important activities due to fatigue that is the main determinant of long-term quality of life. Thus, one of the primary goals of fatigue management is to help patients to maintain personally valued social roles and activities. Before implementing fatigue management interventions, it is important to assess fatigue using valid and reliable tools in order to be able to measure the success (or side effects) of these interventions.

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ASSESSMENT OF SUBJECTIVE FATIGUE

Self-report scales are the tools employed most frequently for the standard assessment of subjective fatigue (Shahid, Wilkinson, Marcu, & Shapiro, 2011). The most important considerations to take into account when choosing a questionnaire are: (a) the fatigue construct that the questionnaire captures, and (b) what is known about the validity and reliability of the questionnaire in the target population. With respect to the first question, clinicians must determine what aspects of fatigue they wish to assess and choose a questionnaire that taps into those. For example, some scales assess the intensity of fatigue, some focus on the perceived functional consequences of fatigue, and others contain items concerning both the intensity and the perceived impact of fatigue on patients' lives.

The simplest scale that can be used for the assessment of fatigue intensity is a one-item visual analogue scale (VAS). The VAS is a 100 mm line that is anchored at either end

with labels designating an absence of fatigue and extreme fatigue. Patients place an X on the line to indicate the degree of their subjective fatigue (a distance of 1 mm from the end indicating no fatigue is equivalent to a score of 1). This tool can be used for quick assessment of fatigue intensity; if given to the same patient repeatedly, scores can be compared over time. One useful application of this scale is in the repeated assessment of fatigue intensity before, during, and after dialysis to capture dialysis-related changes in fatigue intensity.

From a quality-of-life perspective, the most important aspects of fatigue are the perceived impacts on social roles and the functional limitations that patients attribute to their tiredness. One of the most widely used questionnaires to assess the perceived functional consequences of fatigue is the Fatigue Severity Scale (FSS) (Krupp, LaRocca, Muir-Nash, & Steinberg, 1989). The advantage of this scale is that average scores have been published for diverse medical populations (e.g., patients with chronic kidney disease, sleep disorders, depression, chronic hepatitis C infection, cancer, Parkinson's disease, multiple sclerosis, systemic lupus erythematosus, and chronic fatigue syndrome), and a well-established cut-off score is available (set at an average score equal to or above four) to detect clinically significant fatigue (Dittner, Wessely, & Brown, 2004; Krupp et al., 1989). There is evidence to suggest that the subjective experience of fatigue is different in various medical populations, and there are questionnaires (e.g., the Chalder Fatigue Scale) that assess different aspects of fatigue, including mental and physical components (Chalder et al., 1993).

The vitality scale of the 36-Item Short Form Health Survey (SF-36) has been used most frequently for the assessment of fatigue in CKD research (Ware & Sherbourne, 1992). It is important to note, however, that vitality and fatigue are different constructs. Therefore, a vitality measure may not adequately capture patients' fatigue experience. Furthermore, the SF-36 and other quality-of-life measures are not designed specifically for fatigue assessment, and the vitality/energy/fatigue items have not been validated independently for the assessment of fatigue. We therefore recommend that instead of (or in addition to) using general measures alone (e.g., the SF-36), fatigue-specific tools should also be added when assessing this construct in CKD populations. Additionally, it is important to evaluate the validity and reliability of fatigue-specific measurement scores in specific CKD patient groups.

CONTRIBUTORS TO FATIGUE IN CKD

Sleep disorders are ubiquitous contributors to fatigue in CKD. Fatigue is the primary daytime concern of patients with chronic insomnia. The prevalence of insomnia is particularly high in patients on maintenance hemodialysis, and it decreases to the rate observed in the general population following renal transplantation (Novak et al., 2006). CKD patients with insomnia (independent of the modality of the renal replacement therapy) report impaired quality of life and more symptoms of depression. They are also more likely to have obstructive sleep apnea (OSA) and restless legs syndrome (RLS) than good sleepers (Novak et al., 2006). Critically, untreated insomnia not only perpetuates fatigue, but also increases the risk of developing depression, which provides a strong rationale for early intervention (Baglioni et al., 2011). It is important to emphasize that the severity of insomnia is not associated with renal function, and there is no relationship between declining renal function and sleep quality over the course of CKD (Novak et al., 2006; Sabbatini et al., 2008). Rather, chronic insomnia is perpetuated by sleep-specific beliefs and coping behaviours that can be targeted using a short cognitive behavioural intervention (see the section regarding fatigue management).

The risk of obstructive sleep apnea is high (20–55%) among patients with CKD and is associated with declining renal function (de Oliveira Rodrigues et al., 2005; Roumelioti et al., 2011; Turek, Ricardo, & Lash, 2012). Screening for OSA remains important after kidney transplantation because of this increased risk (27%), which particularly affects older male patients with more than three comorbidities and impaired renal function (Molnar, Szentkiralyi, Lindner, Czira, Szabo, et al., 2007). Identifying patients at high risk for the disease is crucial because untreated OSA increases the risks of hypertension, endothelial dysfunction, cardiovascular and cerebrovascular diseases, and diabetes (Aronsohn, Whitmore, Van Cauter, & Tasali, 2010; Hoyos, Melehan, Liu, Grunstein, & Phillips, 2015; Iftikhar, Hoyos, Phillips, & Magalang, 2015; Peppard, Young, Palta, & Skatrud, 2000; Redline et al., 2010; Wang et al., 2007; Yaggi et al., 2005). Furthermore, increased risk of OSA is an independent predictor of impaired quality of life in patients after kidney transplantation (Molnar, Szentkiralyi, Lindner, Czira, Szabo, et al., 2007). It is important to know that OSA can maintain fatigue without causing excessive daytime sleepiness, especially in women and in older patients; therefore, the risk of OSA should not be underestimated in these populations (Morrell, Finn, McMillan, & Peppard, 2012).

RLS may disrupt sleep and is an important predictor of insomnia in CKD (Molnar, Szentkiralyi, Lindner, Czira, Szeifert, et al., 2007). In addition to disrupting sleep continuity, it is also associated with depression—both in patients on dialysis treatment and in individuals living with a kidney transplant (Szentkiralyi et al., 2009). Finally, RLS is associated with pain and limitations in physical functioning independent of insomnia and depression (Szentkiralyi et al., 2009). The above effects of RLS—separately, or in combination—can amplify fatigue.

Fatigue is a core component of the diagnostic criteria of depressive disorders (American Psychiatric Association, 2013). The prevalence of depression in the CKD population is almost four times that of the general population. The highest prevalence rate (39%) is reported among patients with advanced CKD, but a large proportion (approximately 25%) of pre-dialysis and transplant populations also report clinically significant symptoms of depression (Palmer et al., 2013). Depressive symptoms are associated with reduced quality of life, increased mortality, greater decline in glomerular filtration rate, the likelihood of initiating dialysis

earlier, increased hospitalization, and increased mortality in CKD (Kellerman, Christensen, Baldwin, & Lawton, 2010; Palmer et al., 2013; Tsai et al., 2012). Fatigue and depression have a directly proportional association among individuals with advanced CKD: an increased severity of depression is linked with greater fatigue (Bai, Lai, Lee, Chang, & Chiou, 2015). Bearing in mind the association between fatigue and depression, as well as the impact of depression on morbidity and mortality, the importance of screening for depression in patients with CKD becomes clear.

Anemia is a common complication of chronic renal failure and begins early, as renal function declines. Anemia leads to fatigue, weakness, increased hospitalization, and increased morbidity and mortality (Holland & Lam, 2000; Levin, Djurdjev, Duncan, Rosenbaum, & Werb, 2006). Although anemia itself responds to treatment with erythropoietin-stimulating agents and nutritional supplementation, the evidence surrounding the effectiveness of these interventions in reducing fatigue is preliminary and the hemoglobin levels required to achieve optimal improvements in fatigue have not been firmly established.

Like many other chronic illnesses, chronic kidney disease is seen as a pro-inflammatory state with elevated circulating cytokines and other inflammatory markers (Bergstrom et al., 2000). Inflammatory markers can contribute to fatigue through multiple pathways, including: an alteration in the functioning of the hypothalamic-pituitary-adrenal axis; the induction of anemia through suppression of erythropoiesis; contributions to hypoalbuminemia and malnutrition; and a change in the sensitivity of the peripheral ergo-receptors on muscles, which may increase the likelihood of muscle fatigue (Jhamb, Weisbord, Steel, & Unruh, 2008). Though each of these mechanisms is plausible, there is equivocal evidence regarding the relationship between inflammation and fatigue in chronic medical conditions (including chronic inflammatory diseases). Therefore, the relationship between inflammatory markers and fatigue is still largely theoretical and, from a clinical perspective, fatigue management should primarily focus on fatigue-perpetuating factors that can be changed with simple, well-established clinical interventions, as described below.

FATIGUE MANAGEMENT

Fatigue is typically a multi-factorial issue, thus, fatigue management often entails multiple steps. The first of these is fatigue assessment using carefully selected tools. In patients with clinically significant fatigue, the next step is a systematic assessment of medical and psychological factors that may maintain fatigue. Given the ubiquity of sleep disorders across all stages of CKD, it is imperative to screen for the most common sleep disorders, namely, chronic insomnia, sleep apnea, and RLS. Patients who score above the cut-off on questionnaires evaluating sleep will benefit from a clinical sleep assessment and referral to a sleep clinic. Notably, chronic insomnia does not necessitate a referral to a sleep clinic when observed in the general population (if symptoms of other sleep disorders are not present). However, given the high prevalence of comorbid sleep conditions in CKD, many of which can be diagnosed only with polysomnography, a lower threshold for referrals may be warranted. Chronic insomnia and sleep apnea do not require treatment with medication. This may be an important factor in motivating patients to seek treatment for their sleep problems in cases where they already feel burdened by the multiple medications they require. It is important to know that a short cognitive behavioural intervention (CBT-I) is the first-line recommended treatment for chronic insomnia and has been shown to be effective in treating insomnia in patients with CKD and other chronic medical conditions (e.g., chronic pain, cancer, and COPD) (Chen et al., 2008; Espie et al., 2008; Kapella et al., 2011; Vitiello, Rybarczyk, Von Korff, & Stepanski, 2009). There is evidence indicating that CBT-I alleviates fatigue and symptoms of depression, and that it also enhances the treatment of depression (Dirksen & Epstein, 2008; Manber et al., 2008). Thus, CBT-I can be an important component of fatigue management in patients with fatigue, insomnia, and depression.

Considering the high prevalence of depression in the CKD population and the numerous changes to social roles, physical health, psychological well-being, and cognitive abilities that occur as a result of the disease, it is imperative that all individuals with CKD are screened for depression. Though some debate the difference between depressive symptoms and clinical depression, our clinical approach has been to endeavour to address depressive symptoms, irrespective of whether or not individuals meet the diagnostic criteria. This involves managing amenable precipitating and maintaining factors and taking a bio-psycho-social-spiritual approach to therapeutic interventions, which may include counselling, psychological treatment, and pharmacotherapy (Zalai, Szeifert, & Novak, 2012). Cognitive behavioural therapy, an evidence-based treatment for clinical depression, has been shown to effectively treat depression in the CKD population when delivered in both individual and group formats (Cukor et al., 2014; Duarte, Miyazaki, Blay, & Sesso, 2009). It is usually provided over 12 to 20 one-hour sessions and focuses on the perpetuating factors of depression by helping patients to recognize the relationship between thoughts, emotions, and actions. Other psychological interventions such as interpersonal psychotherapy, mindfulness-based stress reduction (MBSR), and relaxation programs may also be beneficial (Gross et al., 2010; Tsai et al., 2015). Pharmacological treatments focus primarily on using selective serotonin reuptake inhibitors (SSRI), which are first-choice antidepressants for clinical depression of at least moderate severity (Nagler, Webster, Vanholder, & Zoccali, 2012). The choice of antidepressant should be based on the interaction and adverse effect profile of the medication and the patient's tolerance to its adverse effects.

Higher hemoglobin levels are associated with improved survival and health-related quality of life, including reduced symptoms of fatigue and depression (Klang, Bjorvell, & Clyne, 1996). In the current post-erythropoietin era, the treatment of anemia in patients on dialysis is more robust than ever before. However, it has raised questions related

to determining ideal hemoglobin levels, optimizing quality of life, reducing morbidity and mortality and, at the same time, preventing any negative effects of overzealous correction of hemoglobin levels. With respect to the effects that anemia treatment has on fatigue in dialysis patients, a recent review concluded that the maximum (35%) improvement in fatigue occurred when baseline hemoglobin levels were below 10 g/dl and a partial correction of >10 g/dl was achieved. This was compared to higher baseline hemoglobin levels (>11 g/dl) and a correction to >12 g/dl (Johansen et al., 2012).

In pre-dialysis CKD patients, there is a direct relationship between hemoglobin levels and scores on physical functioning and energy levels observed using health-related quality-of-life measures (Alexander, Kewalramani, Agodoa, & Globe, 2007). In one study, patients were treated with darbopoetin alfa, resulting in a mean increase in hemoglobin levels from 9.1 g/dl to 11.3 g/dl at eight weeks and 12.6 g/dl at 16 weeks. This intervention was associated with a statistically significant improvement on the SF-36, Functional Assessment of Cancer Therapy (FACT) fatigue scale, and Kidney Disease Quality of Life Instrument (Alexander et al., 2007). These findings suggest that treatment of anemia reduces fatigue across the whole spectrum of CKD.

Fatigue in renal failure may increase, as a result of decreased physical activity and deconditioning. It may also occur as the direct effect of uremic toxins on muscle health or because of malnutrition. Resistance exercise results in skeletal muscle hypertrophy, increased muscle strength, and functional ability; aerobic exercise leads to improved physical conditioning, greater cardiac functioning, reduced systolic and diastolic blood pressure, reduced dyslipidemia, insulin resistance, and, ultimately, better quality of life (Kosmadakis et al., 2010). Despite awareness of these benefits and decades of research regarding the impact of exercise on different aspects of health in CKD, the implementation of exercise in actual clinical practice remains limited. Recommendations for exercise regimens that could be applied among patients with advanced CKD have been adapted from exercise guidelines for older adults (>65 years) and individuals between 50 and 64 years of age with chronic conditions or functional limitations published by the American College of Sports Medicine and American Heart Foundation (Johansen, 2008; Nelson et al., 2007). There is evidence that integrating specific exercise programs that combine cardiovascular and resistance training into hemodialysis regimens can improve physical strength, performance, and quality of life. These regimens also have good long-term adherence (Anding et al., 2015; Smart & Steele, 2011). In addition, intradialytic exercise can effectively reduce fatigue and improve physical functioning in both active and sedentary individuals with advanced CKD (Chang, Cheng, Lin, Gau, & Chao, 2010).

CONCLUSION

Clinically significant fatigue has a direct and tangible impact on the everyday functioning and quality of life of patients with chronic kidney disease and, therefore, should be in the forefront of patient care. Sleep disorders, depression, anemia, and sedentary lifestyle are common perpetuating factors of fatigue in this population. These issues can be effectively addressed through targeted interventions, and there is evidence to support that these interventions alleviate fatigue in CKD. Nurses are in a unique position to intervene given that they often have long-term interactions with these patients. This allows them the opportunity to obtain first-hand information from patients about fatigue, sleep problems, depression, and lifestyle factors. This relationship also provides the potential to monitor the effectiveness of interventions. Asking patients about their subjective experiences is invaluable in recognizing clinically significant fatigue and the presence of issues that may contribute to it. Adding carefully selected fatigue, sleep, and depression scales to the assessment regimen is important for screening and symptom monitoring. It is crucial to acknowledge that fatigue is not an inevitable component of kidney disease. As a clinical intervention, fatigue management has the potential to improve patients' quality of life irrespective of the type or degree of CKD.

REFERENCES

American Psychiatric Association. (2013). *Diagnostic and statistical manual of mental disorders* (5th ed.). Washington, DC: Author.

Alexander, M., Kewalramani, R., Agodoa, I., & Globe, D. (2007). Association of anemia correction with health related quality of life in patients not on dialysis. *Current Medical Research and Opinion, 23*(12), 2997–3008. doi:10.1185/030079907X242502

Anding, K., Bar, T., Trojniak-Hennig, J., Kuchinke, S., Krause, R., Rost, J.M., & Halle, M. (2015). A structured exercise programme during haemodialysis for patients with chronic kidney disease: Clinical benefit and long-term adherence. *BMJ Open, 5*(8), e008709. doi:10.1136/bmjopen-2015-008709

Aronsohn, R.S., Whitmore, H., Van Cauter, E., & Tasali, E. (2010). Impact of untreated obstructive sleep apnea on glucose control in type 2 diabetes. *American Journal of Respiratory and Critical Care Medicine, 181*(5), 507–513. doi:10.1164/rccm.200909-1423OC

Baglioni, C., Battagliese, G., Feige, B., Spiegelhalder, K., Nissen, C., Voderholzer, U., … Riemann, D. (2011). Insomnia as a predictor of depression: A meta-analytic evaluation of longitudinal epidemiological studies. *Journal of Affective Disorders, 135*(1–3), 10–19. doi:10.1016/j.jad.2011.01.011

Bai, Y.L., Lai, L.Y., Lee, B.O., Chang, Y.Y., & Chiou, C.P. (2015). The impact of depression on fatigue in patients with haemodialysis: A correlational study. *Journal of Clinical Nursing, 24*(13–14), 2014–2022. doi:10.1111/jocn.12804

Bergstrom, J., Lindholm, B., Lacson, E., Jr., Owen, W., Jr., Lowrie, E. G., Glassock, R. J., … Zimmermann, J. (2000). What are the causes and consequences of the chronic inflammatory state in chronic dialysis patients? *Seminars in Dialysis, 13*(3), 163–175.

Boksem, M.A., & Tops, M. (2008). Mental fatigue: Costs and benefits. *Brain Research Reviews, 59*(1), 125–139. doi:10.1016/j.brainresrev.2008.07.001

Chalder, T., Berelowitz, G., Pawlikowska, T., Watts, L., Wessely, S., Wright, D., & Wallace, E.P. (1993). Development of a fatigue scale. *Journal of Psychosomatic Research, 37*(2), 147–153.

Chang, Y., Cheng, S.Y., Lin, M., Gau, F.Y., & Chao, Y.F. (2010). The effectiveness of intradialytic leg ergometry exercise for improving sedentary life style and fatigue among patients with chronic kidney disease: A randomized clinical trial. *International Journal of Nursing Studies, 47*(11), 1383–1388. doi:10.1016/j.ijnurstu.2010.05.002

Chen, H.Y., Chiang, C.K., Wang, H.H., Hung, K.Y., Lee, Y.J., Peng, Y.S., … Tsai, T.J. (2008). Cognitive-behavioral therapy for sleep disturbance in patients undergoing peritoneal dialysis: A pilot randomized controlled trial. *American Journal of Kidney Diseases, 52*(2), 314–323. doi:10.1053/j.ajkd.2008.03.012

Cukor, D., Ver Halen, N., Asher, D.R., Coplan, J.D., Weedon, J., Wyka, K.E., … Kimmel, P.L. (2014). Psychosocial intervention improves depression, quality of life, and fluid adherence in hemodialysis. *Journal of the American Society of Nephrology, 25*(1), 196–206. doi:10.1681/ASN.2012111134

De Oliveira Rodrigues, C.J., Marson, O., Tufic, S., Kohlmann, O., Jr., Guimaraes, S.M., Togeiro, P., … Tavares, A. (2005). Relationship among end-stage renal disease, hypertension, and sleep apnea in nondiabetic dialysis patients. [Research Support, Non-U.S. Gov't]. *American Journal of Hypertension, 18*(2 Pt 1), 152–157. doi:10.1016/j.amjhyper.2004.08.028

Dirksen, S.R., & Epstein, D.R. (2008). Efficacy of an insomnia intervention on fatigue, mood and quality of life in breast cancer survivors. *Journal of Advanced Nursing, 61*(6), 664–675. doi:10.1111/j.1365-2648.2007.04560.x

Dittner, A.J., Wessely, S.C., & Brown, R.G. (2004). The assessment of fatigue: A practical guide for clinicians and researchers. *Journal of Psychosomatic Research, 56*(2), 157–170.

Duarte, P.S., Miyazaki, M.C., Blay, S.L., & Sesso, R. (2009). Cognitive-behavioral group therapy is an effective treatment for major depression in hemodialysis patients. *Kidney International, 76*(4), 414–421. doi:10.1038/ki.2009.156

Espie, C.A., Fleming, L., Cassidy, J., Samuel, L., Taylor, L.M., White, C.A., … Paul, J. (2008). Randomized controlled clinical effectiveness trial of cognitive behavior therapy compared with treatment as usual for persistent insomnia in patients with cancer. *Journal of Clinical Oncology, 26*(28), 4651–4658.

Gross, C.R., Kreitzer, M.J., Thomas, W., Reilly-Spong, M., Cramer-Bornemann, M., Nyman, J.A., … Ibrahim, H.N. (2010). Mindfulness-based stress reduction for solid organ transplant recipients: A randomized controlled trial. *Alternative Therapies in Health and Medicine, 16*(5), 30–38.

Holland, D.C., & Lam, M. (2000). Predictors of hospitalization and death among pre-dialysis patients: A retrospective cohort study. *Nephrology, Dialysis, Transplantation, 15*(5), 650–658.

Hoyos, C.M., Melehan, K.L., Liu, P.Y., Grunstein, R.R., & Phillips, C.L. (2015). Does obstructive sleep apnea cause endothelial dysfunction? A critical review of the literature. *Sleep Medicine Reviews, 20,* 15–26. doi:10.1016/j.smrv.2014.06.003

Iftikhar, I.H., Hoyos, C.M., Phillips, C.L., & Magalang, U.J. (2015). Meta-analyses of the association of sleep apnea with insulin resistance, and the effects of CPAP on HOMA-IR, adiponectin, and visceral adipose fat. [Research Support, N.I.H., Extramural]. *Journal of Clinical Sleep Medicine, 11*(4), 475–485. doi:10.5664/jcsm.4610

Jhamb, M., Argyropoulos, C., Steel, J.L., Plantinga, L., Wu, A.W., Fink, N.E., … Unruh, M.L. (2009). Correlates and outcomes of fatigue among incident dialysis patients. *Clinical Journal of the American Society of Nephrology, 4*(11), 1779–1786.

Jhamb, M., Weisbord, S.D., Steel, J.L., & Unruh, M. (2008). Fatigue in patients receiving maintenance dialysis: A review of definitions, measures, and contributing factors. *American Journal of Kidney Diseases, 52*(2), 353–365. doi:10.1053/j.ajkd.2008.05.005

Johansen, K.L. (2008). Exercise and dialysis. [Review]. *Hemodialysis International, 12*(3), 290–300. doi:10.1111/j.1542-4758.2008.00269.x

Johansen, K.L., Finkelstein, F.O., Revicki, D.A., Evans, C., Wan, S., Gitlin, M., & Agodoa, I.L. (2012). Systematic review of the impact of erythropoiesis-stimulating agents on fatigue in dialysis patients. *Nephrology, Dialysis, Transplantation, 27*(6), 2418–2425. doi:10.1093/ndt/gfr697

Kapella, M.C., Herdegen, J.J., Perlis, M.L., Shaver, J.L., Larson, J.L., Law, J.A., & Carley, D.W. (2011). Cognitive behavioral therapy for insomnia comorbid with COPD is feasible with preliminary evidence of positive sleep and fatigue effects. *International Journal of Chronic Obstructive Pulmonary Disease, 6,* 625–635.

Kellerman, Q.D., Christensen, A.J., Baldwin, A.S., & Lawton, W.J. (2010). Association between depressive symptoms and mortality risk in chronic kidney disease. *Health Psychology, 29*(6), 594–600. doi:10.1037/a0021235

Klang, B., Bjorvell, H., & Clyne, N. (1996). Quality of life in predialytic uremic patients. *Quality of Life Research, 5*(1), 109–116.

Kosmadakis, G.C., Bevington, A., Smith, A.C., Clapp, E.L., Viana, J.L., Bishop, N.C., & Feehally, J. (2010). Physical exercise in patients with severe kidney disease. *Nephron Clinical Practice, 115*(1), c7–c16. doi:10.1159/000286344

Krupp, L.B., LaRocca, N.G., Muir-Nash, J., & Steinberg, A.D. (1989). The fatigue severity scale. Application to patients with multiple sclerosis and systemic lupus erythematosus. *Archives of Neurology, 46*(10), 1121–1123.

Kutner, N.G., Brogan, D., & Fielding, B. (1997). Physical and psychosocial resource variables related to long-term survival in older dialysis patients. *Geriatric Nephrology and Urology, 7*(1), 23–28.

Levin, A., Djurdjev, O., Duncan, J., Rosenbaum, D., & Werb, R. (2006). Haemoglobin at time of referral prior to dialysis predicts survival: An association of haemoglobin with long-term outcomes. *Nephrology, Dialysis, Transplantation, 21*(2), 370–377. doi:10.1093/ndt/gfi209

Manber, R., Edinger, J.D., Gress, J.L., San Pedro-Salcedo, M.G., Kuo, T.F., & Kalista, T. (2008). Cognitive behavioral therapy for insomnia enhances depression outcome in patients with comorbid major depressive disorder and insomnia. *Sleep, 31*(4), 489–495.

Molnar, M.Z., Szentkiralyi, A., Lindner, A., Czira, M.E., Szabo, A., Mucsi, I., & Novak, M. (2007). High prevalence of patients with a high risk for obstructive sleep apnoea syndrome after kidney transplantation--association with declining renal function. *Nephrology, Dialysis, Transplantation, 22*(9), 2686–2692. doi:10.1093/ndt/gfm246

Molnar, M.Z., Szentkiralyi, A., Lindner, A., Czira, M.E., Szeifert, L., Kovacs, A.Z., … Novak, M. (2007). Restless legs syndrome and mortality in kidney transplant recipients. *American Journal of Kidney Diseases, 50*(5), 813–820. doi:10.1053/j.ajkd.2007.08.003

Morrell, M.J., Finn, L., McMillan, A., & Peppard, P.E. (2012). Aging reduces the association between sleepiness and sleep disordered breathing. *European Respirology Journal, 40*(2), 386–393.

Nagler, E.V., Webster, A.C., Vanholder, R., & Zoccali, C. (2012). Antidepressants for depression in stage 3-5 chronic kidney disease: A systematic review of pharmacokinetics, efficacy and safety with recommendations by European Renal Best Practice (ERBP). *Nephrology, Dialysis, Transplantation, 27*(10), 3736–3745. doi:10.1093/ndt/gfs295

Nelson, M.E., Rejeski, W.J., Blair, S.N., Duncan, P.W., Judge, J.O., King, A.C., … Castaneda-Sceppa, C. (2007). Physical activity and public health in older adults: Recommendation from the American College of Sports Medicine and the American Heart Association. [Congresses]. *Circulation, 116*(9), 1094–1105. doi:10.1161/CIRCULATIONAHA.107.185650

Novak, M., Molnar, M.Z., Ambrus, C., Kovacs, A.Z., Koczy, A., Remport, A., … Mucsi, I. (2006). Chronic insomnia in kidney transplant recipients. *American Journal of Kidney Diseases, 47*(4), 655–665. doi:10.1053/j.ajkd.2005.12.035

Palmer, S., Vecchio, M., Craig, J.C., Tonelli, M., Johnson, D.W., Nicolucci, A., … Strippoli, G.F. (2013). Prevalence of depression in chronic kidney disease: Systematic review and meta-analysis of observational studies. *Kidney International, 84*(1), 179–191. doi:10.1038/ki.2013.77

Peppard, P.E., Young, T., Palta, M., & Skatrud, J. (2000). Prospective study of the association between sleep-disordered breathing and hypertension. *The New England Journal of Medicine, 342*(19), 1378–1384. doi:10.1056/NEJM200005113421901

Redline, S., Yenokyan, G., Gottlieb, D.J., Shahar, E., O'Connor, G.T., Resnick, H.E., … Punjabi, N.M. (2010). Obstructive sleep apnea-hypopnea and incident stroke: The sleep heart health study. *American Journal of Respiratory and Critical Care Medicine, 182*(2), 269–277. doi:10.1164/rccm.200911-1746OC

Roumelioti, M.E., Buysse, D.J., Sanders, M.H., Strollo, P., Newman, A.B., & Unruh, M.L. (2011). Sleep-disordered breathing and excessive daytime sleepiness in chronic kidney disease and hemodialysis. *Clinical Journal of the American Society of Nephrology: CJASN, 6*(5), 986–994. doi:10.2215/CJN.05720710

Sabbatini, M., Pisani, A., Crispo, A., Ragosta, A., Gallo, R., Pota, A., … Cianciaruso, B. (2008). Sleep quality in patients with chronic renal failure: A 3-year longitudinal study. *Sleep Medicine, 9*(3), 240–246. doi:10.1016/j.sleep.2007.04.005

Shahid, A., Wilkinson, K., Marcu, S., & Shapiro, C.M. (2011). *STOP, THAT and One Hundred Other Sleep Scales.* New York, NY: Springer.

Shen, J., Barbera, J., & Shapiro, C.M. (2006). Distinguishing sleepiness and fatigue: Focus on definition and measurement. *Sleep Medicine Reviews, 10*(1), 63–76.

Smart, N., & Steele, M. (2011). Exercise training in haemodialysis patients: A systematic review and meta-analysis. *Nephrology (Carlton), 16*(7), 626–632. doi:10.1111/j.1440-1797.2011.01471.x

Szentkiralyi, A., Molnar, M.Z., Czira, M.E., Deak, G., Lindner, A.V., Szeifert, L., … Novak, M. (2009). Association between restless legs syndrome and depression in patients with chronic kidney disease. *Journal of Psychosomatic Research, 67*(2), 173–180. doi:10.1016/j.jpsychores.2009.05.004

Tsai, S.H., Wang, M.Y., Miao, N.F., Chian, P.C., Chen, T.H., & Tsai, P.S. (2015). CE: original research: The efficacy of a nurse-led breathing training program in reducing depressive symptoms in patients on hemodialysis: A randomized controlled trial. *The American Journal of Nursing, 115*(4), 24–32; quiz 33, 42. doi:10.1097/01.NAJ.0000463023.48226.16

Tsai, Y.C., Chiu, Y.W., Hung, C.C., Hwang, S.J., Tsai, J.C., Wang, S.L., … Chen, H.C. (2012). Association of symptoms of depression with progression of CKD. [Research Support, Non-U.S. Gov't]. *American Journal of Kidney Diseases, 60*(1), 54–61. doi:10.1053/j.ajkd.2012.02.325

Turek, N.F., Ricardo, A.C., & Lash, J.P. (2012). Sleep disturbances as nontraditional risk factors for development and progression of CKD: Review of the evidence. *American Journal of Kidney Diseases, 60*(5), 823–833. doi:10.1053/j.ajkd.2012.04.027

Vitiello, M.V., Rybarczyk, B., Von Korff, M., & Stepanski, E.J. (2009). Cognitive behavioral therapy for insomnia improves sleep and decreases pain in older adults with co-morbid insomnia and osteoarthritis. *Journal of Clinical Sleep Medicine, 5*(4), 355–362.

Wang, H., Parker, J.D., Newton, G.E., Floras, J.S., Mak, S., Chiu, K.L., … Bradley, T.D. (2007). Influence of obstructive sleep apnea on mortality in patients with heart failure. *Journal of the American College of Cardiology, 49*(15), 1625–1631. doi:10.1016/j.jacc.2006.12.046

Ware, J.E., Jr., & Sherbourne, C.D. (1992). The MOS 36-item short-form health survey (SF-36). I. Conceptual framework and item selection. *Medical Care, 30*(6), 473–483.

Yaggi, H.K., Concato, J., Kernan, W.N., Lichtman, J.H., Brass, L.M., & Mohsenin, V. (2005). Obstructive sleep apnea as a risk factor for stroke and death. *The New England Journal of Medicine, 353*(19), 2034–2041. doi:10.1056/NEJMoa043104

Zalai, D., Szeifert, L., & Novak, M. (2012). Psychological distress and depression in patients with chronic kidney disease. *Seminars in Dialysis, 25*(4), 428–438. doi:10.1111/j.1525-139X.2012.01100.x

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(T) (_____) _____ - _____

Courriel _____

Employeur _____

Adresse de l'émployer _____

Ville _____

Province _____ Code postal _____

Adresse de correspondance ❑ domicile ❑ travail

Acceptez-vous que l'ACITN ajoute votre nom et votre adresse sur des listes d'envois qu'elle juge pertinentes et appropriées?
❑ Oui ❑ Non

Avez-vous consentez à l'utilisation de votre e-mail pour toute correspondance avec l'ACITN?
❑ Oui ❑ Non

❑ Nouveau membre ou ❑ Renouvellement

Numéro de l'ACITN (si renouvellement):_____

Frais d'adhésion (TPS #100759869)
Les frais d'adhésion sont deductibles d'impots.
❑ Un an : 70,00 $ + TVH/TPS
❑ Deux ans : 130,00 + TVH/TPS
❑ Tarif étudiant : 35,00 + TVH/TPS*
**La demande doit inclure une preuve d'inscription à plein temps*
AB/BC/SK/MB/NT/NU/QC/YT : 5 % TPS; ON/NL/NB: 13 % TVH; PE: 14 % TVH; NS : 15 % TVH

Je joins $ _____
payable à l'ACITN.

Mode de paiement :
❑ Chèque ❑ Mandat de poste ou chèque visé
❑ Visa ❑ Mastercard

Nom du titulaire de la carte : _____

Numéro de la carte : _____

Date d'expiration : _____

Signature : _____

❑ J'ai obtenu la désignation CNeph(C)/cdt

❑ Je suis membre de l'ACI

Demandeurs de l'Ontario seulement
Faites vous partie de l'AOIA?
❑ Oui ❑ Non

Statut professionel
❑ Infirmière(ier) autorisée(sé)
❑ Infirmière(ier) auxilaire autorisée(sé) / infirmière(ier) auxilaire
❑ Technicienne/technicien
❑ Technologue
❑ Autre (spécifier) _____

Années d'éxperience en néphrologie _____

Domain de responsabilité
❑ Soins directs
❑ Administration
❑ Technologie
❑ Enseignement
❑ Recherche
❑ Autre (spécifier)

_____

Milieu de travail
❑ Soins actifs
❑ Unité d'autosoins
❑ Services de santé indépendants
❑ Secteur privé

Plus haut niveau d'instruction?

Infirmière(ier)	*Autres*
❑ Diplôme	❑ Diplôme
❑ Baccalauréat	❑ Baccalaureat
❑ Maîtrise	❑ Maîtrise
❑ Doctorat	❑ Doctorat

Je poursuis présentement des études

Domaine infirmière(ier)	*Autre domaine*
❑ Certificat	❑ Certificat
❑ Baccalauréat	❑ Baccalauréat
❑ Maîtrise	❑ Maîtrise
❑ Doctorat	❑ Doctorat

Secteur de pratique spécialisé
❑ Insuffisance rénale progressive (pré-dialyse)
❑ Transplantation
❑ Hémodialyse
❑ Péritonéale
❑ Pédiatrie
❑ Autre (spécifier) _____

Poster à **ACITN**
Adresse postale :

CANNT/ACITN
P.O. Box 10, 59 Millmanor Place, Delaware, ON N0L 1E0
Téléphone (519) 652-6767 Télécopieur (519) 652-5015

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