CANNT JOURNAL
JOURNAL ACITN

Official publication of the Canadian Association of Nephrology Nurses and Technologists

Volume 32, Issue 4
October–December 2022

ISSN 2291-644X (Online)
ISSN 1498-5136 (Print)

IN THIS ISSUE

CANNT|ACITN
Canadian Association of Nephrology Nurses and Technologists
l'Association canadienne des infirmières et infirmiers et des technologues de néphrologie


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Canadian Association of Nephrology Nurses and Technologists
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OCTOBER–DECEMBER 2022 • VOLUME 32 • ISSUE 4

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IN EACH ISSUE:

The CANNT Journal is printed on recycled paper.

The CANNT Journal is the official publication of the Canadian Association of Nephrology Nurses and Technologists. 4 Cataraqui St., Suite 310, Kingston, ON K7K 1Z7, telephone: (613) 507-6053, fax: 1-866-303-0626, email: cannt@cannt.ca. Published quarterly, the journal is received by all members of CANNT. Subscriptions are: Canada $80.00 (plus HST), US. $90.00, Outside N. America $115.00. Back issues, when available, are $7.50 (+HST) per issue and are available from the editors. Opinions expressed by writers in the CANNT Journal are not necessarily those held by the editors or CANNT. Contrasting views by our readership and membership are welcome. All letters, comments and articles are to be sent to the CANNT office, 4 Cataraqui St., Suite 310, Kingston, ON K7K 1Z7.

1-877-720-2819
Website: www.cannt.ca

The CANNT Journal accepts articles (manuscripts) on an ongoing basis.

The CANNT Journal is indexed in the Cumulative Index to Nursing and Allied Health Literature (CINAHL), the International Nursing Index (INI), MEDLINE, EBSCO, ProQuest and Thomson Gale.

ISSN 2291-644X (Online)
ISSN 1498-5136 (Print)

The CANNT Journal is produced by Pappin Communications,
www.pappin.com

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Letter from the Editors

Greetings,

We hope you are faring well as we approach the close of 2022. For those who attended the CANNT Conference in Hamilton this past October, we hope you have remained as inspired and invigorated as you were at the conference. The organizing committee from Hamilton accomplished an amazing feat: They did a great job in delivering a conference that entertained, educated, and challenged the audience to think outside of the proverbial box all at once. In keeping with the theme of *Guiding our Way to the Future*, we left Hamilton with renewed commitment to deliver quality care to the respective patient population we serve.

At *CANNT Journal*, we have a small but very talented team who ensure that what we offer in every issue of the journal is quality work, as we showcase excellence in nephrology nursing and technological writing. We would like to acknowledge Events Management Plus (CANNT's national office) for their unparalleled professionalism, efficiency, and commitment to CANNT and the *CANNT Journal*. Our editorial efforts would be for naught were it not for the support of our partners at EM+. We are indebted to the authors and contributors to the journal for their time and generosity in sharing their unique research and practice interests in the *CANNT Journal*. Similarly, our viability as a journal also rests with the contribution of the manuscript peer reviewers, and our partnership and collaboration with Pappin Communications and Lemieux Bédard – we thank them for their generosity in sharing their knowledge and expertise. Last, we thank our journal readership for your interest and consumption of our quarterly publication. We heavily encourage nephrology nurses and technologists to submit manuscripts for publication in the *CANNT Journal* in the form of observational studies, clinical trials, case reports, literature reviews, solutions that address clinical practice issues, or quality improvement projects. We wish to remind the readership that manuscript submission to the *CANNT Journal* is now fully online. You may submit online **https://cannt-acitn.ca/cannt-journal-new/**

In this issue, we look at a single centre's experience with vascular access management that may have practical implications for the hemodialysis community at large. In *Pharmacomechanical declotting of thrombosed arteriovenous accesses*, Quinan et al. (2022) describe a viable and innovative option for preserving and ensuring the longevity of the *sine qua non* of hemodialysis: the arteriovenous access. In our Continuing Education Series offering *Evaluating the safety of common herbal supplements in chronic kidney disease, dialysis, and kidney transplant patients*, Lee and Battistella (2022) provide a cautionary tale of how herbal supplements can impact the care and management of people with chronic kidney disease, receiving dialysis, or who have had a kidney transplant, particularly the potential drug-herb interactions. We hope you enjoy this edition.

On behalf of the team at the *CANNT Journal*, we wish you and your loved ones a safe and wonderful holiday season, and an amazing start to the new year.

Warm regards from your *CANNT Journal* co-editors,

Jovina Bachynski
MN-NP Adult, RN(EC), CNeph(C), PhD Student

Rosa M. Marticorena
CNS, CNeph(C), DClinEpi, PhD

Message des rédactrices en chef

Salutations à tous et à toutes,

Nous espérons que tout le monde se porte bien à l'approche de la fin de l'année 2022. Pour les personnes ayant assisté au congrès de l'ACITN à Hamilton en octobre dernier, nous espérons que vous êtes toujours aussi inspirés et stimulés que vous l'étiez pendant l'évènement. Le comité d'organisation a réalisé un formidable exploit en proposant un congrès qui, en plus d'être divertissant et instructif, a su éveiller la pensée créatrice des participants. Inspirés par le thème du congrès (En route vers l'avenir), nous sommes repartis d'Hamilton avec un engagement renouvelé à fournir des soins de qualité à nos patients.

Notre petite mais très talentueuse équipe de la *Revue de l'ACITN* veille à présenter des travaux de qualité dans chaque numéro afin de mettre en valeur l'excellence des soins infirmiers et des écrits technologiques en néphrologie. Nous tenons à remercier les employés du bureau national de l'ACITN (Events Management Plus, EM+) pour leur professionnalisme, leur efficacité et leur engagement inégalés envers l'ACITN et sa revue. Nos efforts éditoriaux seraient vains sans leur aide. Nous sommes reconnaissantes envers les auteurs et les contributeurs ayant généreusement consacré leur temps à exprimer leurs intérêts uniques en matière de recherche et de pratique en néphrologie dans la *Revue de l'ACITN*. Le succès de notre périodique repose aussi sur la contribution des pairs examinateurs ainsi que sur nos partenariats et notre collaboration avec Pappin Communications et Lemieux Bédard. Nous les remercions pour le temps, les connaissances et l'expertise qu'ils ont la grande générosité de nous offrir. Enfin, nous tenons à remercier nos lecteurs de l'intérêt qu'ils portent à nos publications trimestrielles. Nous encourageons vivement la communauté de soins infirmiers et de technologues en néphrologie à nous soumettre des manuscrits sous forme d'études observationnelles, d'essais cliniques, d'études de cas, de revues de la littérature, de solutions à des problèmes cliniques et de projets d'amélioration de la qualité. Nous aimerions vous rappeler que la soumission des manuscrits à la *Revue de l'ACITN* se fait désormais en ligne à l'adresse **https://cannt-acitn.ca/cannt-journal-new/**.

Dans ce numéro, nous abordons l'expérience d'une clinique en matière de gestion de l'accès vasculaire. Il s'agit de connaissances pouvant avoir des répercussions pratiques pour les patients hémodialysés. Puis, dans l'article intitulé *Pharmacomechanical declotting of thrombosed arteriovenous accesses*, les auteurs (Quinan, *et al*. 2022) décrivent une option viable et innovante pour préserver l'accès par fistule artérioveineuse en cas d'hémodialyse. De plus, vous trouverez un article issu de la série sur la formation continue : *Evaluating the safety of common herbal supplements in chronic kidney disease, dialysis, and kidney transplant patients*. Dans ce texte, les auteurs (Lee et Battistella, 2022) présentent une mise en garde concernant les suppléments à base de plantes, qui peuvent avoir une incidence sur les soins et la prise en charge des patients atteints d'une maladie rénale chronique, qui sont sous dialyse ou qui ont reçu une greffe rénale. Le texte porte précisément sur les interactions potentielles entre les médicaments et les plantes. Nous espérons que vous apprécierez ce numéro.

Au nom de toute l'équipe de la *Revue de l'ACITN*, nous vous souhaitons à vous et à vos proches de passer de joyeuses fêtes en toute sécurité ainsi qu'un merveilleux début d'année.

Salutations cordiales de la part des rédactrices de la *Revue de l'ACITN*,

Jovina Bachynski
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Rosa M. Marticorena
ICS, CNeph(C), D.E.S. Épidémiologie clinique, Ph. D.

Le *Journal ACITN* est la publication officielle de l'Association canadienne des infirmiers/infirmières et technologues en néphrologie. 4, rue Cataraqui, bureau 310, Kingston (Ontario) K7K 1Z7.

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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, au 4, rue Cataraqui, bureau 310, Kingston (Ontario) K7K 1Z7.

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Le *Journal ACITN* accepte des articles (manuscrits) de façon continue.

Le *Journal ACITN* est maintenant répertorié dans le *Cumulative Index to Nursing and Allied Health Literature (CINAHL), International Nursing Index (INI), MEDLINE, EBSCO, ProQuest* et *Thomson Gale.*

ISSN 2291-644X (En ligne)
ISSN 1498-5136 (Dans la presse)

Le *Journal ACITN* est préparé par Pappin Communications,
www.pappin.com

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President's Message

It is hard to believe that a full year has gone by since I became your president. This has been a year full of uncertainty with many healthcare crises including Covid-19 outbreaks, staffing shortages, and supply chain disruptions. But we, as nephrology healthcare professionals, are resilient and share a vision of an optimistic future where there are many places to find hope.

CANNT is certainly one of those places to find hope. Our first conference post-pandemic with its relevant theme on *Guiding our Way to the Future* was a resounding success. Dr. Zayna Khayat, our opening keynote speaker, identified many innovations in technology that directly impact and change how we care for our nephrology patients in the future. As a healthcare future strategist, she also discussed the change in patient expectations that demand us to become more adept at restructuring and reinvention. In short, we have to change the ways we do things in health care. We understand that some members could not attend the conference and participate in this presentation due to staffing shortages. We will therefore continue to have all presentations available on the website for your convenience. I would like to send a huge shout-out to the CANNT Conference (Hamilton) committee for their hard work in organizing such a wonderful conference.

Congratulations also to the award and bursary winners who were recognized at the AGM in Hamilton. A complete list of the winners may be found in this issue of the journal.

Looking forward to the 2023 CANNT Conference being held in beautiful Prince Edward Island. I would like to thank our PEI Conference Team for stepping up and volunteering their time – it is my sincerest hope that you will find this experience to be both professionally and personally rewarding. Please mark your calendars for October 2023 for what promises to be another excellent opportunity for professional growth and networking with colleagues.

CANNT will continue to strive to prepare our nephrology members to anticipate, plan, and organize for these future challenges. We are set to begin our monthly webinars in the new year, and we will be looking for your input for potential topics and learning needs. Please take the time to respond as we welcome your feedback to ensure your needs are heard. This initiative would not be possible without our Events Management Plus team who work tirelessly behind the scenes to keep our organization moving forward. I would also like to acknowledge our industry partners and corporate sponsors for their continued support.

Our Board of Directors has undergone changes as Patty Quinan and Bettiann Curran have finished their terms as VP Ontario and VP Atlantic, respectively. On behalf of the Board, I would like to thank Patty and Bettiann for their time, expertise, and years of commitment to CANNT. We wish you all the best with your future endeavours. I extend our sincerest thanks to our new members, Lisa Robertson (VP Ontario) and Joan MacDonald (VP Atlantic), for coming on board. We know this experience will enhance your professional growth and strengthen your practice.

As the holidays season approaches, I would like to wish all members a safe, healthy, and happy holiday season.

Cathy Cake, M.Ed., BN, RN, CNeph(C)
CANNT President 2021–2023

Message de la présidente

Il est difficile de croire qu'une année entière s'est écoulée depuis que je suis devenue votre présidente. Dans la dernière année, le domaine des soins de santé a été marqué par l'incertitude et de nombreuses crises, notamment la pandémie de COVID-19, des pénuries de personnel et des perturbations de la chaîne d'approvisionnement. Heureusement, les professionnels de la santé en néphrologie font preuve d'une grande résilience. Notre vision commune de l'avenir est teintée d'optimisme et d'espoir, comme en témoignent les activités de l'ACITN. D'ailleurs, notre premier congrès post-pandémie « En route vers l'avenir », un thème bien choisi, a connu un succès retentissant. La Dre Zayna Khayat, qui a donné le coup d'envoi à cette conférence, a souligné plusieurs innovations technologiques qui auront une influence directe sur la façon dont nous soignerons nos patients en néphrologie à l'avenir. Spécialiste de l'avenir des soins de santé, elle nous a également parlé de l'évolution des attentes des patients, qui nous forcera à modifier et à réinventer notre façon de procéder dans le domaine de la santé. Nous comprenons que certains membres n'ont pas été en mesure d'y participer en raison d'un manque de personnel. C'est pourquoi nous continuerons de mettre toutes les présentations à votre disposition sur le site Web. J'aimerais remercier chaleureusement le comité du congrès de l'ACITN à Hamilton, qui a travaillé sans relâche pour organiser ce formidable évènement.

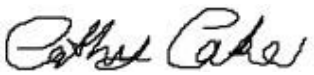
Félicitations également aux personnes ayant reçu des prix et des bourses d'études pendant l'assemblée générale annuelle qui s'est tenue à Hamilton. Vous trouverez la liste des lauréats dans ce numéro de la revue.

Nous avons déjà hâte au congrès 2023 de l'ACITN, qui se tiendra dans la magnifique province de l'Île-du-Prince-Édouard. J'aimerais remercier les membres de l'équipe de l'Île-du-Prince-Édouard qui ont accepté de faire don de leur temps pour organiser l'évènement. J'espère sincèrement que vous trouverez cette expérience enrichissante sur le plan professionnel et personnel. Inscrivez la date à vos calendriers, car le prochain congrès aura lieu en octobre 2023. Ce sera sans l'ombre d'un doute une autre fabuleuse occasion de développement professionnel et de réseautage entre collègues.

L'ACITN continuera à tout mettre en œuvre pour aider les membres de la communauté de néphrologie à bien se préparer aux défis qu'ils auront à relever. Nous organiserons d'ailleurs des webinaires mensuels au cours de la prochaine année et nous aimerions avoir vos suggestions de sujets à aborder et de besoins d'apprentissage à combler. Veuillez prendre le temps de nous faire part de vos commentaires et nous veillerons à ce que votre voix soit entendue. Merci également à l'équipe d'Events Management Plus, qui redouble d'efforts en coulisses pour faire progresser notre organisation. Je tiens aussi à remercier nos partenaires de l'industrie et nos commanditaires commerciaux pour leur soutien habituel.

Il y a eu du changement au sein du conseil d'administration de l'ACITN. En effet, Patty Quinan et Bettiann Curran ont terminé leur mandat respectif de vice-présidente de l'Ontario et de vice-présidente de l'Atlantique. Au nom du conseil, j'aimerais remercier Patty et Bettiann pour leur temps, leur expertise et leurs années de dévouement envers l'ACITN. Nous vous souhaitons beaucoup de succès dans vos projets. J'adresse également des remerciements sincères à Lisa Robertson (nouvelle v.-p. de l'Ontario) et Joan MacDonald (nouvelle v.-p. de l'Atlantique), qui se sont jointes au conseil d'administration. Nous savons que cette expérience contribuera à votre épanouissement professionnel et au renforcement de votre pratique.

Je vous souhaite de joyeuses fêtes en toute sécurité, dans le bonheur et la santé,



Cathy Cake, MEd, BN, RN, CNeph(C)
Présidente de l'ACITN 2021–2023

Your Board in Action

It is a delight to write to you as your President-Elect/Treasurer for CANNT. I want to express my sincere and deep appreciation for your continued perseverance and dedication. I continue to be amazed and inspired by the aptitude, talent, and commitment represented by nephrology professionals throughout Canada. Thank you for everything you do for the advancement of nursing and CANNT as we thrive to achieve new heights in making Canada a healthier, better place. CANNT continues to acknowledge and applaud your hard work in providing exemplary nephrology care.

Our leadership team is energized this year as we work harder towards strengthening our membership, education, health policy and advocacy, research and practice, and financial status. To that end, you will notice that we have a new VP Ontario (Lisa Robertson) and a new VP Atlantic (Joan MacDonald). Please help me welcome Lisa and Joan to the CANNT Board of Directors. Thank you to those who supported the CANNT National Conference (*Guiding our Way to the Future*) in Hamilton this October. We had an amazing turnout of nephrology professionals, and exceptional research and practice presentations.

This year, the CANNT leadership will focus on empowering you to realize the vision and mission of the organization as it aligns with your desires for your professional lives and practices.

I would like to express my heartfelt gratitude for your commitment to CANNT. I cannot wait to see, hear, and experience all the great things we are going to accomplish together.

Wishing you and your loved ones Merry Christmas and Happy Holidays…

Regards,

Alicia Moonesar

Dr. Alicia Moonesar, DNP, MScN, NP-PHC
CANNT President-Elect/ Treasurer
2021–2023

Votre conseil à l'œuvre

Je suis ravie de vous écrire à titre de présidente désignée et trésorière de l'ACITN. Je tiens à vous exprimer ma sincère et profonde reconnaissance pour votre persévérance et votre dévouement de tous les instants. Les aptitudes, le talent et l'implication des professionnels de la néphrologie de partout au Canada ne cessent de m'émerveiller et de m'inspirer. Merci de tout ce que vous faites pour l'avancement de la pratique infirmière et merci à l'ACITN, qui vise de nouveaux sommets d'excellence au Canada en matière de santé, un objectif qui serait impossible sans les incroyables efforts que consacrez afin d'offrir des soins de santé exemplaires en néphrologie.

L'équipe de direction est pleine d'énergie cette année et met tout en œuvre pour relever encore la barre en ce qui concerne nos effectifs, la formation, les orientations, la promotion de la santé, la recherche, la pratique et notre situation financière. J'en profite d'ailleurs pour souligner que nous avons une nouvelle vice-présidente pour la région de l'Ontario (Lisa Robertson) ainsi qu'une nouvelle vice-présidente pour la région de l'Atlantique (Joan MacDonald). Au nom de toute l'équipe, je souhaite la bienvenue à Lisa et Joan au sein du conseil d'administration de l'ACITN. Merci également à ceux qui ont contribué au succès du congrès national de l'ACITN (*Guiding our Way to the Future*) à Hamilton en octobre dernier. De nombreux professionnels de la néphrologie y ont participé et nous avons eu droit à des présentations exceptionnelles axées sur la recherche et la pratique.

Au cours de l'année qui vient, l'équipe de direction s'efforcera de vous donner tous les moyens de concrétiser la vision et la mission de l'ACITN, qui s'alignent sur vos objectifs de pratique professionnelle.

Je tiens à vous exprimer ma sincère gratitude pour votre engagement envers l'ACITN. J'ai hâte de voir se matérialiser tous les projets que nous réaliserons ensemble dans l'avenir.

Je vous souhaite un joyeux Noël et de belles fêtes de fin d'année en compagnie de vos proches.

Cordialement,

Alicia Moonesar

Dre Alicia Moonesar, DPI., M. Sc. Inf., IPSPL
Présidente désignée et trésorière de l'ACITN
2021–2023

NOTICE BOARD

- Canadian Nurses Association (CNA) Exam Timeline. **https://www.cna-aiic.ca/en/certification/about-certification**

	Spring 2023	Fall 2023
Initial exam or renewal by exam application window	January 11–March 31, 2023	June 5–September 30, 2023
Certification exam window	May 1–15, 2023	November 1–15, 2023
Renewal by continuous learning application window	January 11–November 15, 2023	

- **March 3–6, 2023.** 43rd Annual Dialysis Conference (ADC) 2023. Marriott Downtown Kansas City, Kansas City, MO. **https://annualdialysisconference.org/**
- **March 9, 2022.** World Kidney Day – *Kidney Health for All: Preparing for the Unexpected, Supporting the Vulnerable!* **https://www.worldkidneyday.org/2023-campaign/2023-wkd-theme/**
- **March 30–April 2, 2023.** International Society of Nephrology (In-Person) World Congress of Nephrology (WCN'23). Queen Sirikit National Convention Center (QSNCC), Bangkok, Thailand. **https://www.theisn.org/wcn/**
- **April 11–15, 2023.** National Kidney Foundation (NKF) Spring Clinical Meetings 2023. Austin Convention Center, Austin, Texas. **https://www.kidney.org/spring-clinical**
- **May 7–10, 2023.** American Nephrology Nurses' Association (ANNA) National Symposium. Renaissance Palm Springs & Palm Springs Convention Center, Palm Springs, CA. **https://www.annanurse.org/events/2023-national-symposium**
- **May 29–31, 2023.** Renal Society of Australasia (RSA) Annual Conference. Sydney Masonic Centre, Sydney, Australia. Darwin Convention Centre, Darwin, Australia. **https://www.renalsociety.org/education/2023-annual-conference/**
- **June 15–18, 2023.** 60th European Renal Association (ERA) Congress | Milan & Virtual 2023. Milano Convention Centre (MiCo), Milan, Italy. **https://www.era-online.org/events/milan-2023/**
- **September 20, 2023.** Nephrology Health Care Professionals' Day (celebrated every third Wednesday of September annually)
- **October 27–29, 2022.** CANNT National Conference, Hamilton, ON
- **November 2–5, 2023.** American Society of Nephrology (ASN) 2023 Kidney Week. Pennsylvania Convention Center, Philadelphia, PA. **https://www.asn-online.org/education/kidneyweek/**
- **September 26–29, 2024.** International Society for Peritoneal Dialysis (ISPD) Congress. Dubai World Trade Center, Dubai, UAE. **www.ispd.org/dubai2024**

CANADIAN NURSES ASSOCIATION

Nephrology Certification Registration Status Report 2022

Initial and Renewal by Exam to Renew in 2022	Renewal by Continuous Learning (CL) Hours	Total of Initials and Renewals	Due
49	20	69	191

Pharmacomechanical declotting of thrombosed arteriovenous accesses

By Patricia Quinan, Allan Yee, and Balraj Panesar

ABSTRACT

Purpose: *Preservation of arteriovenous (AV) access is key to avoiding central venous catheter (CVC) placement. CVCs have been associated with complications such as infection, thrombosis, and central vein stenosis, which can limit future vascular access options. We describe our local percutaneous thrombolysis process with overnight pharmacological thrombolysis to treat clotted AV accesses (fistulas and grafts).*

Description: *An environmental scan in Canada identified that the majority of nephrology programs perform a combination of percutaneous and surgical procedures, without overnight thrombolysis. Our local percutaneous treatment of thrombosed AV accesses includes duplex ultrasound to identify extent of the thrombus; overnight hospital admission; fistulogram and angioplasty with pharmacological and mechanical thrombolysis; overnight pharmacological thrombolysis with suitability determined by the interventional radiologist; and fistulogram with/without angioplasty the following day to determine AV access patency.*

Evaluation/outcomes: *Thrombolysis data from April 2015 to December 2021 (81 months) identified 142 cases with 135 procedures (average 1.67% per month). Seven cases did not undergo a procedure (unsuitable/patient refusal) and were excluded from the data set. Of the 135 cases, 92.59% of procedures were completed within five days or less and there was an equal distribution of upper and lower arm fistulas (40.85% and 39.44%, respectively), with fewer grafts (19.72%). ICU bed availability was 93.6%, and lack of bed availability did not result in access loss. Overnight thrombolysis was performed in 24.44% of cases, and post procedure outcomes were equal for upper and lower arm fistulas with a higher loss seen in grafts. Successful declotting was achieved in 80.74% of cases and 19.26% of cases were unsuccessful. Of the cases that underwent overnight thrombolysis, 17.78% were successful and 6.67% were unsuccessful. Of the 19.26% of cases that were unsuccessful, 12.59% (17 cases) were deemed not salvageable by the interventional radiologist due to multiple procedures, age of access, aneurysms, and failed surgeries. Adverse events were observed in two cases (1.48%); one case with suspected contrast allergy developed urticaria, angioedema and shortness of breath, and the second case developed a decrease in oxygen saturation levels, shortness of breath, hyperkalemia, and fluid overload.*

Implications for nephrology practice/education: *Our unique approach with overnight thrombolysis for the treatment of thrombosed AV accesses may be considered by other programs as a strategy to improve AV access patency and overall AV access rates.*

Keywords: arteriovenous fistulas, arteriovenous grafts, hemodialysis, declotting, thrombolysis, pharmacomechanical, thrombus, clots

AUTHOR NOTE

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BACKGROUND

Preserving and maintaining functional arteriovenous (AV) accesses (lifeline) is paramount to avoiding insertion of hemodialysis (HD) central venous catheters (CVC) (Zaleski, 2004; Richard, 2011). HD CVCs are a type of central venous access device (CVAD). The term CVC will be used exclusively throughout the paper to describe HD CVCs and does not pertain to other types of CVADs.

Patients receiving HD treatment with a CVC have a two- to three-fold increased risk of vascular access infections compared to patients receiving HD with an arteriovenous fistula (AVF) or arteriovenous graft (AVG). (Al-Barshomy et al., 2021). CVCs are associated with the highest risk of hospitalization due to catheter-related infection (Al-Balas et al., 2017), and increased infection, death, and cardiovascular events (Ravani et al., 2013). CVCs are also associated with an increased risk of thrombosis with partial or complete central vein occlusion at the site of the stenosis (Krishna et al., 2016), increased morbidity and mortality (Kosa & Lok, 2013; Ravani et al., 2013; Quinan et al., 2015; Al-Balas et al., 2017; Al-Balas et al., 2019; Lok et al., 2020), as well other risks including endocarditis, major organ abscesses, and recurrent sepsis (Kotwal et al., 2020).

Ferguson et al. (2021) estimate the cost of infection-related hospital admission in Canada at $11,938.53. The Canadian Institute for Health Information (CIHI, 2016a) reports that 11.5% of hospitalizations are due to infections related to dialysis treatments, dialysis patients have a higher hospital rate and average cost of hospital stay, as compared

to the general population ($13,634 and $6,066, respectively), and the average daily cost in the intensive care unit (ICU) at $3,592 (CIHI, 2016b). The estimated average costs of a standard hospital stay are $7,619 and $6,656 in Canada and Ontario, respectively (CIHI, 2020).

Strategies to reduce catheter-related infections and associated risks include increasing incident and prevalent use of AV accesses (fistulas and grafts) and developing vascular access guidelines for preventing catheter-related infections (Collier & Davenport, 2014; CIHI, 2016a). Furthermore, it is critical to extend the functional life of each AV access and salvage AV accesses as access sites are limited and patients are dependent on dialysis for survival (Zaleski, 2004; Alhaizaey et al., 2020).

Early referral to the nephrologist enables an early plan for venous preservation that is a substantial part of the pre-dialysis care and education. Adopting this approach may help to minimize the use of catheters and reduce catheter-related morbidity and hospitalization (Schmidli et al., 2018). Lok et al. (2020) discuss the concept of the patient's life-plan, whereby "the individualized set of kidney replacement modalities (hemodialysis, peritoneal dialysis and transplantation) takes into consideration the patient's current and anticipated medical and life circumstances and preferences, and recommends that the life-plan should be regularly re-evaluated given expected changes in a patient's life circumstances" (p. S11).

LITERATURE REVIEW

For the treatment of thrombosed AV accesses, percutaneous endovascular interventions are widely used and an effective alternative to surgical approaches (Semaan et al., 2015; Dariushnia et al., 2016; Quencer & Oklu, 2017; Alhaizaey et al., 2020). Multiple studies report that surgical declotting is not as successful as percutaneous approaches (Bent et al., 2011; Quencer & Friedman, 2017; Quencer & Oklu, 2017; Alhaizaey et al., 2020), and report success rates with percutaneous approaches of 73–100% (Vorwerk et al., 1996; Coentrao et al., 2010; Elkharboutly & Raslan, 2016) and lower radiation dose than surgical approaches (Semaan et al., 2015).

Percutaneous transluminal angioplasty (PTA) for the treatment of thrombosed AV accesses was first introduced in the early 1980s and has been evolving over the years (Cynamon & Pierpont, 2002). Thrombolysis techniques include: pulse spray-aided pharmacomechanical thrombolysis (first described in 1995) (Valji et al., 1995; Cynamon & Pierpont, 2002; Quencer & Oklu, 2017); lysis and wait (30-120 minutes; first described in 1997; Cynamon et al., 1997; Quencer & Oklu, 2017); use of mechanical thrombectomy devices (Cildag & Koseoglu, 2017; Quencer & Oklu, 2017); open surgical thrombectomy (Ghaffarian et al., 2018); and thromboaspiration (Cildag & Koseoglu., 2017; Quencer & Oklu, 2017).

Thrombosis of the AVF is a common complication and accounts for 65–85% of permanent access loss (MacRae et al., 2016; Quencer & Friedman, 2017). Following the creation of AVFs, early-onset thrombosis is most commonly the result of inadequate blood flow or inflow problem, and late-onset thrombosis is associated with stenotic lesions or outflow problem (Smits et al., 2000; MacRae et al., 2016). Immature or new fistulas that have not sufficiently enlarged enough to be used adequately for HD increase patients' morbidity and mortality (Duque et al., 2017). Additional maturation procedures include PTA. Shin et al. (2005) and Alhaizaey et al. (2020) report that PTA continues to be the gold-standard treatment and is an efficacious method for the correction of AVF stenosis and prolonging AVF patency.

Although the success rate of long-term patency is lower for immature AVFs, performing venogram and angioplasty (diagnostic or therapeutic) is recommended rather than abandoning access site (Turmel-Rodrigues et al., 2000; Beathard et al., 2003; Lee et al., 2013). AVFs are created from native tissue and are inherently non-thrombogenic (Zaleski, 2004). When compared with grafts, fistulas are less likely to clot (Falk et al., 2013; Quencer & Friedman, 2017) and need less blood flow to maintain patency (Zaleski, 2004; Falk et al., 2013). As AVFs are non-thrombogenic, removing all the clot is not as critical as it is with AVGs. Zaleski (2004) suggests that "as long as there is adequate blood flow through the fistula and no large amount of clot, that the fistula will clear small amounts of residual clots over time. If, however, large or obstructing clot is present, the clot would need to be cleared or removed before the declotting procedure is considered completed" (p. 86).

Declotting AVFs generally requires greater technical skill and experience in the initial cannulation and catheterization than AVGs (Turmel-Rodrigues et al., 2000). Fistulas have a thin venous wall, which is more difficult to palpate (Brescia et al., 1966). The anatomy is irregular and often impossible to localize the AV anastomosis (Mehta, 1991). Stenosis most commonly occurs in the venous segment distal to the AV anastomosis (Allon, 2007) and it can also be located in the feeding artery to the central veins (Kumpe & Cohen, 1992). The underlying stenosis is often very tight and difficult to localize and traverse (Poulain et al, 1991). AVFs can have both arterial and venous stenoses (Zaleski, 2004), collaterals are deceptive (Sands et al., 1994), generally contain a large volume of clots (Trerotola et al., 1994), aneurysms are more common and may contain layers of wall-adherent thrombi (Vorwerk et al., 1994), concomitant thrombosis of the artery is not rare, and sharp angulation of the AV anastomosis may make it impossible to traverse the underlying stenosis (Valji et al., 1995).

Aneurysm formation is also more common in AVFs (Pietura et al., 2005; Mudoni et al., 2015; Al-Jaishi et al., 2017) and can result from repeated needle punctures in a clustered areas over time, thereby, weakening the vascular access wall (Mudoni et al., 2015; Al-Jaishi et al., 2017). Thrombus can include a short segment or extend to the level of the central veins (Quencer & Oklu, 2017) and the success rate of declotting fistulas is lower than grafts (Turmel-Rodrigues et al., 2000; Kakkos et al., 2008). Brachiocephalic (BCF) upper arm fistulas occlude more frequently with lower long-term patency rates than forearm radiocephalic (RCF) fistulas. Furthermore, stenosis in the cephalic vein are more common and more resistant to angioplasty (Turmel-Rodrigues, 2000; Rajan et al., 2003).

In contrast, AVGs are easy to palpate and cannulate and have a constant diameter with an average clot volume of 3.2 mL (Winkler et al., 1995). AVGs are thrombogenic and therefore need optimal blood flow after the declotting procedure to remain patent (Zaleski, 2004). The composition of the thrombus is more predictable and extends the entire length of the graft from the arterial anastomosis to the venous anastomosis (Quencer & Olku, 2017), and 95% of AVGs thrombose due to venous anastomosis stenosis (Turmel-Rodrigues et al., 2000: Falk et al., 2013; Elkharboutly & Raslan, 2016).

Contraindications to performing thrombolysis include infection (fever usually unrelated to fistula thrombosis and arm tenderness usually reflects thrombosis, not infection) (Zaleski, 2004; Coentrao et al., 2010), large aneurysmal fistulas (Coentrao et al., 2010; Quencer & Oklu, 2017), and patients who are deemed hemodynamically unstable (Quencer & Oklu, 2017). Adverse events with percutaneous thrombolysis include pulmonary embolism or anastamotic disruption, which can be avoided/minimized with proper patient selection (Quencer & Oklu, 2017), and successfully managed by an interventional radiologist (Elkharboutly & Raslan, 2016). Percutaneous approach should be attempted first as long as local interventional radiologists are trained and motivated (Turmel-Rodrigues et al., 2000).

Physical examination of the fistula is not as strong a screening tool as grafts in predicting AV access thrombosis (Falk et al., 2013; Quencer & Friedman, 2017; Quencer & Oklu, 2017). Physical examination of AVGs is a useful screening tool to identify grafts that are at risk, however other causes of thrombosis such as hypotension are not easily detected by physical examination (Falk et al., 2013).

Lok et al. (2020) state that "the fundamental principle for performing routine vascular access monitoring and surveillance is to detect and correct the stenosis to minimize or avoid reduced dialysis clearance (dialysis dose protection), reduce the rate of thrombosis, and improve AV access function." (p. S81). Monitoring strategies of AV accesses include physical examination (inspection, palpation, and auscultation) to detect physical signs that suggest the presence of physical pathology (Beathard, 2002; Koirala et al., 2016, Lok et al., 2020). Monitoring also includes regular review of routine laboratory studies obtained in the dialysis unit, dialysis adequacy (urea reduction ratio or Kt/V), cannulation difficulties, prolonged hemostasis after needle removal, documented recirculation, and other clinical findings (Kumbar et al., 2012; Koirala et al., 2016). Surveillance consists of periodic evaluation by means of specifically designed tests or device-based methods to evaluate the intra-access flow for signs of dysfunction and ultimately improve longevity of the access and reduce the rate of thrombosis (Kumbar et al., 2012; Koirala et al., 2016; Lok et al, 2020). Surveillance strategies include clinical procedures performed to evaluate intra-access flow (Koirala et al., 2016) such as access flow measurement (Qa), Duplex Doppler ultrasound (Allon et al., 2007; Whittier, 2009; Teodorescu et al., 2012; Bandyk, 2013; Lok et al., 2020) and minimally invasive venography (Whittier, 2009).

Maintaining functional VA requires a team approach, in collaboration with the patient, nephrologist, nurse practitioner, dialysis nurse, dialysis technicians, vascular access coordinator, interventional radiologist, and vascular surgeons (Whittier, 2009). Leivaditis et al. (2014) suggest that implementation of a VA surveillance program could lead to timely detection and intervention of VA dysfunction, and decrease central venous catheter use, hospitalization and VA-related costs.

An environmental scan of nephrology programs in Canada identified that the majority of centres perform a combination of percutaneous and surgical procedures, without overnight thrombolysis, and table time is generally one to one and a half hours (one procedure spot). Some centres perform a staged procedure when the stenosis is greater than 90%. During a staged balloon angioplasty, the interventional radiologist initially uses a 6–7 mm balloon; the patient then returns in one to three weeks and the interventional radiologist uses a 1–2 cm larger balloon (7–9 mm) than what was used during the initial declotting procedure (Zaleski, 2004). The purpose of our project is to describe our local pharmacomechanical processes for declotting thrombosed arteriovenous (AV) accesses.

DESCRIPTION OF THE PRACTICE

Our local four-step process for treating thrombosed AV accesses (AVF and AVG) includes: (a) Duplex Doppler ultrasound of AV access to identify the extent of the thrombus and presence/location of stenosis; (b) fistulogram and angioplasty; declotting procedure with pharmacomechanical thrombolysis procedure, and an ICU bed for possible overnight pharmacological thrombolysis; (c) overnight continuous pharmacological thrombolysis with heparin and Alteplase (as determined by the interventional radiologist based on procedure outcomes); and (d) repeat fistulogram and possible angioplasty on the following day to assess AV access patency/viability.

Preparation for a thrombolysis procedure includes securing two procedure spots (duration two to three hours); instructing patients to have nothing by mouth or *nil per os* (NPO) after midnight; obtaining CBC, electrolytes, blood urea nitrogen (BUN), creatinine, and international normalized ratio (INR) [acceptable INR less than or equal to 3.0], obtaining thrombolysis blood work on the morning of procedure, and establishing intravenous access. Similar to most centres, we use a combined pharmacologic and mechanical approach for percutaneous thrombolysis of clotted AV accesses. The pharmacologic component refers to the use of the thrombolytic agent Alteplase (t-PA), which is injected directly into the clot instead of given systemically. This allows the interventional radiologist to cut down on the dose and avoid most of the bleeding complications.

There are many mechanical thrombectomy methods and systems in use today. Some of these are quite basic and do not require any specialized equipment. For instance, for many years, we declotted fistulas by simply running a partially inflated angioplasty balloon back and forth through the clotted segment. This is a very fast and effective means of

breaking up clots; however, it does have a serious drawback. The clots that are broken up can embolize distally and end up in the lungs as pulmonary emboli (PE). Most patients have enough pulmonary capacity to handle a small amount of PE without any problem. However, there is a small subset of patients with limited cardiopulmonary reserve, and in these patients, any amounts of distal emboli can be catastrophic. For this reason, we only use these simple techniques if there is a small clot burden.

The more advanced mechanical thrombectomy system usually will have a mechanism of preventing distal embolism. The system we have used at our hospital since 2016 is the AngioJet. The AngioJet system consists of two components: the console and specialized catheters (Figure 1).

Figure 1

AngioJet Machine and Specialized Catheters

Note. Permission from Boston Scientific

Intervention

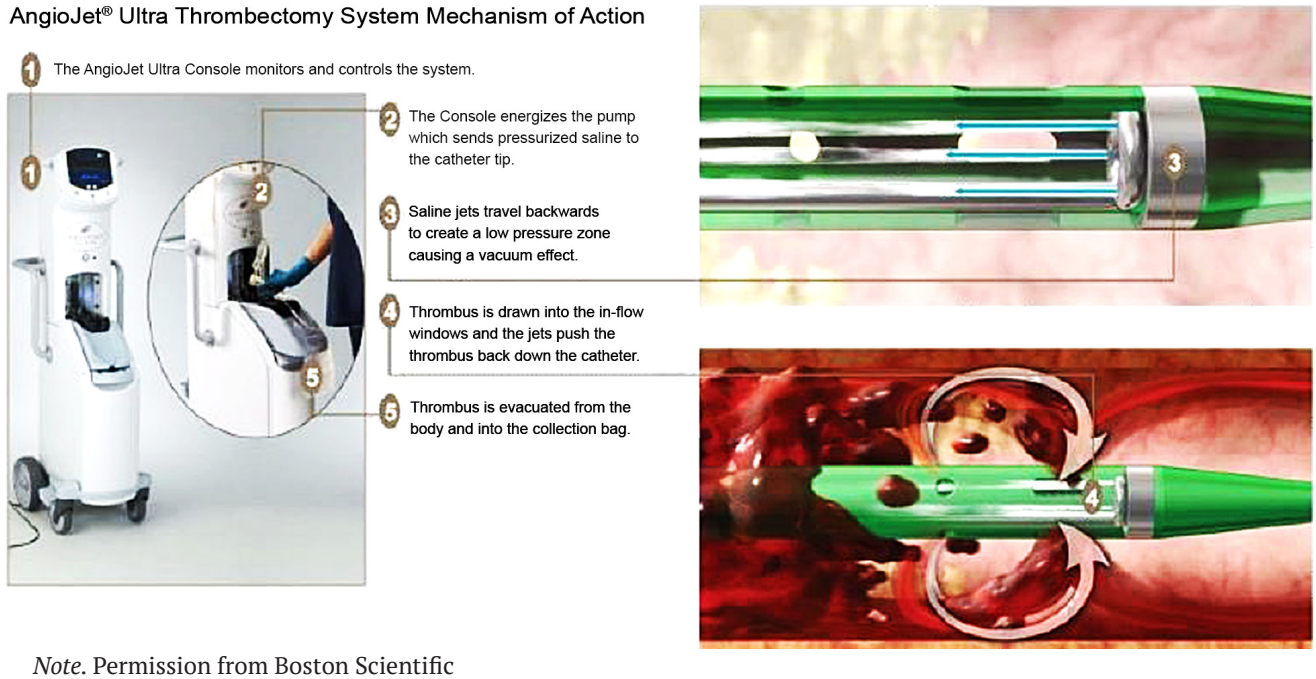
During a percutaneous thrombectomy procedure, the console is connected to one of the catheters by a set of tubing. The catheter is inserted into the clotted AV access where it performs its function of fragmenting and extracting the clots. This system can be used in any situation where there is a need to remove clots from a vascular channel. In addition to thrombosed AV accesses, the AngioJet has been used effectively in the coronary system to treat myocardial infarctions, in the pulmonary artery system to treat PE, and in the venous system to treat deep vein thrombosis. Different catheter designs are available depending on the applications (Figure 1). The green catheter is the one that is generally used for thrombosed AV accesses.

The AngioJet machine's mechanism of action is a direct application of Bernoulli's principle (NASA, n.d.) which states that as the velocity of a fluid increases, the pressure decreases (Figure 2). Within the console, there is a pump that sends pressurized saline to the catheter tip. At the catheter tip, the saline is directed backwards as high velocity saline jets. Based on Bernoulli's principle, a low pressure is created within the catheter tip and this acts like a vacuum to draw clot fragments into the catheter. Once inside the catheter, the clots are further broken down by the saline jets. The saline jets carry the clot fragments back to the console where they are collected.

During a thrombectomy procedure, clot fragments are captured by the vacuum effect created by the saline jets within the catheter. The goal is to prevent any of the clot fragments from embolizing distally. In practice, we pass this

Figure 2

Mechanism of Action



Note. Permission from Boston Scientific

catheter several times back and forth through the thrombosed segment until all the clots are removed. The AngioJet machine can operate in two modes: thrombectomy mode and power pulse mode. Described above is the AngioJet system operating in thrombectomy mode. During the power pulse mode, the inflow windows at the catheter tip are closed off, which converts that catheter into a high-pressure infusion system (Figure 3). The machine infuses Alteplase directly into the clot under high pressure. This enhances clot penetration and ensures that the Alteplase is distributed throughout the entire clot, and thereby maximizing the lytic effect of Alteplase.

To be successful in declotting a thrombosed AV access, we have to accomplish two things. First, we have to remove the clots and secondly, and just as important, we have to treat the underlying lesion(s) that led to clotting in the first place. Invariably, this is due to one or more stenoses along the AV access. First, the AV access is cannulated to provide access for the AngioJet catheter. We use the catheter in the power pulse mode to lace the clots with Alteplase and wait 15 minutes for the Alteplase to soften the clots.

Next, we switch the AngioJet to thrombectomy mode to mechanically fragment and extract the clots from the AV access. Then, we use balloon angioplasty with or without stenting to treat the stenosis. If needed to improve AV access patency, patients are admitted for overnight pharmacological thrombolysis with heparin and continuous Alteplase infusion, and repeat fistulogram and balloon angioplasty the following day. The declotting procedure is considered successful based on AV access patency achieved post-procedure and AV access is successfully used for hemodialysis.

CASE REVIEWS

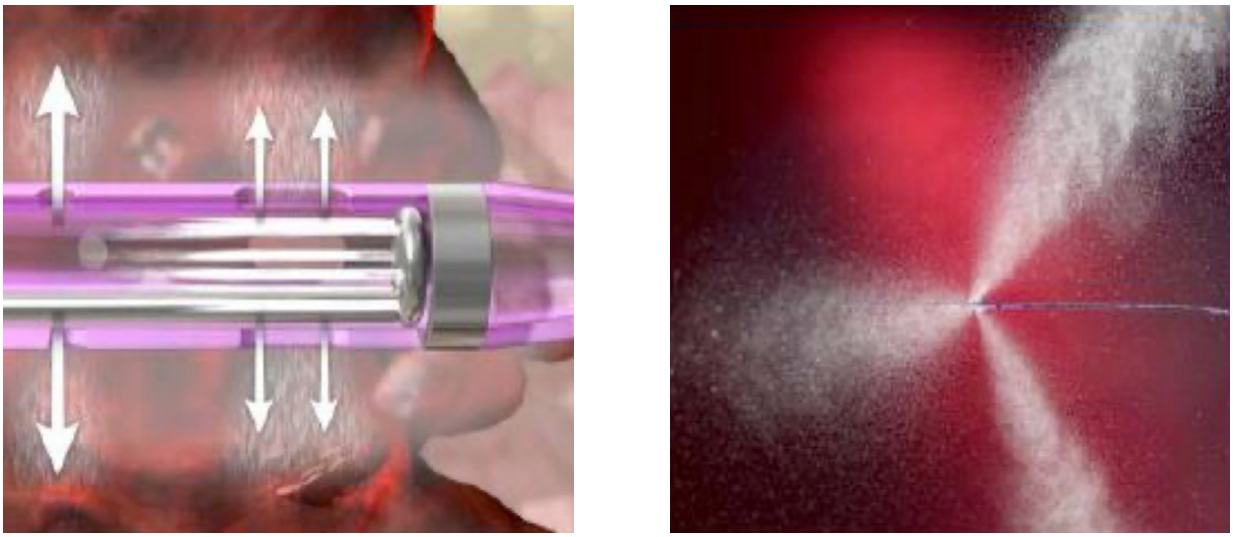
The following four cases of thrombosed AV accesses are provided to demonstrate the spectrum of cases that we encounter at our hospital. There are many more native fistulas than grafts in our hemodialysis patient population, so most of the declotting procedures are performed on AV fistulas. Each case includes a diagram of the Duplex Doppler ultrasound of the thrombosed AV access, an image of the initial fistulogram showing the thrombosed AV access, images of balloon angioplasty, and a final image of the AV access at the completion of the declotting procedure. A follow-up diagram is included of the Duplex Doppler ultrasound within two weeks after the percutaneous thrombectomy procedure. The authors have obtained permission from the Medical Imaging Department at Humber River Hospital to include images in this manuscript.

A Duplex Doppler ultrasound of the AV access is routinely done prior to the declotting procedure. The IR finds the ultrasound to be very helpful in showing the anatomy and how the fistula is laid out in the arm. However, in the absence of blood flow, as is the case with thrombosed AV accesses, the ultrasound is unable to clearly identify the location of stenosis or stenoses. This is only known after the thrombus is removed and a fistulogram is performed.

During a declotting procedure, the interventional radiologist cannulates the draining vein and contrast is injected to confirm thrombosis of the AV access. Next, the AngioJet machine is used in power pulse mode, and Alteplase is injected into the AV access, followed by the thrombectomy mode to remove clots from the AV access. Once most of the clots are cleared or removed, contrast is injected (fistulogram) to visualize the location of the culprit lesions (stenosis) and balloon angioplasty is performed.

Figure 3

Power Pulse Mode



Note. Permission from Boston Scientific

Case 1

The first case is a thrombosed right radiocephalic fistula (RCF) that was created in January 2015 and underwent a declotting procedure in August 2016. The Duplex Doppler ultrasound (Figure 4) demonstrates partially occluding thrombi in the cephalic vein in the forearm and at the elbow (brown shade) and a stenosis in the cephalic vein just past the anastomosis. During the fistulogram procedure, initial contrast is injected that confirms stenosis (green arrow) at the anastomosis and thrombosed (blue arrows) draining vein (Figure 5); image of balloon angioplasty (orange arrow) of anastamotic stenosis (Figure 6); and resolution of stenosis and thrombus (Figure 7); and a follow-up diagram of the Duplex Doppler ultrasound of the patent right RCF (Figure 8).

Figure 4

Duplex Doppler of Thrombosed Right RCF

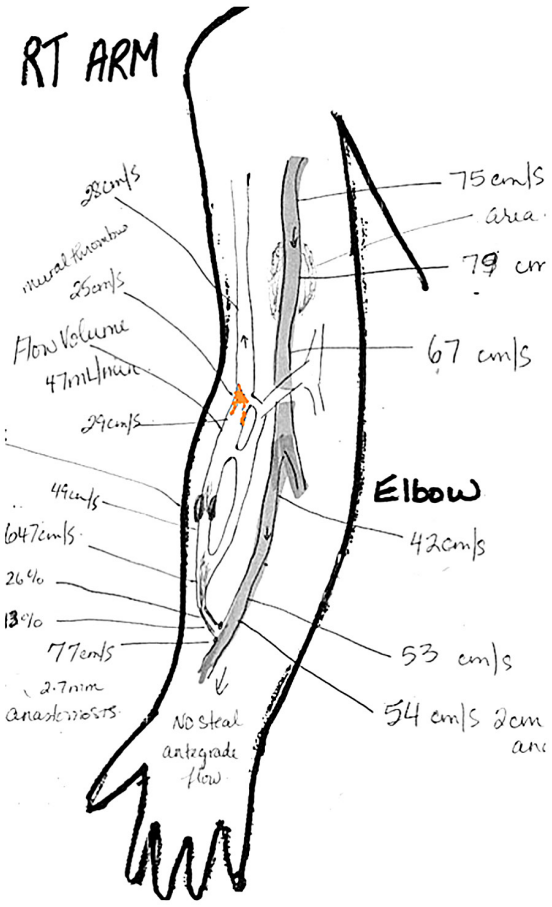
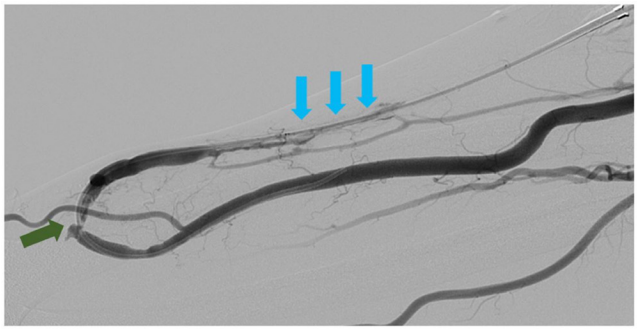


Figure 5

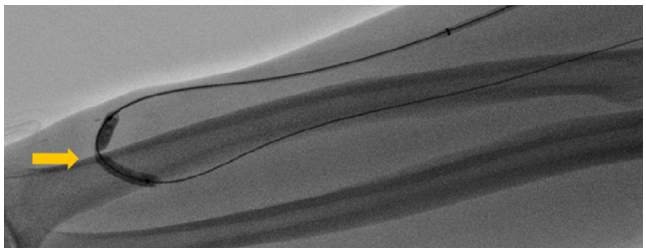
Right RCF with Stenosis at the Anastomosis and Thrombosed Segment



Note. Stenosis (green arrow), thrombosed segment (blue arrows)

Figure 6

Angioplasty (orange arrow) of Anastamotic Stenosis



Note. Angioplasty site (orange arrow)

Figure 7

Resolution of Stenosis and Thrombus in Right Radiocephalic Fistula

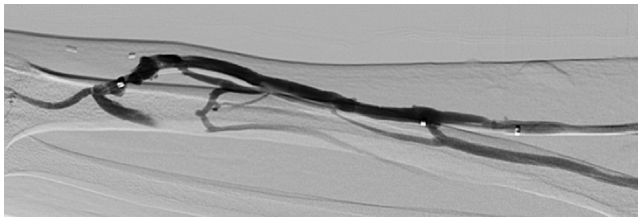
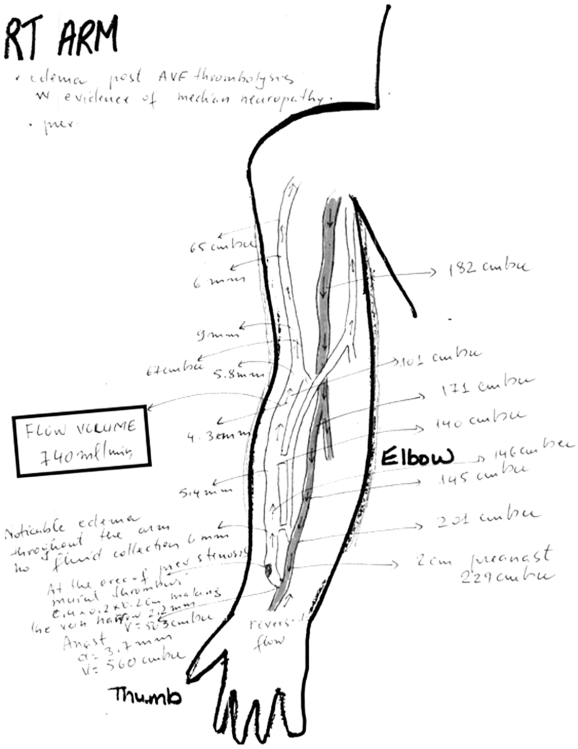


Figure 8

Duplex Doppler Post Successful Declotting of Right RCF



Case 2

The second case is a thrombosed left upper arm brachiocephalic fistula (BCF) created in October 2013 with multiple previous interventions. The Duplex Doppler ultrasound (Figure 9) demonstrates thrombus extending a few centimeters above the AV anastomosis in the draining vein (brown shade). There is a stenosis at the anastomosis, which is not detectable/apparent on Doppler as there is no blood flow in the fistula.

Initial contrast is injected (fistulogram) that confirms the following images: stenosis (green arrow) at AV anastomosis and thrombosed segment (blue arrow) in the draining vein (Figure 10); second stenosis (green arrow) in the draining vein (Figure 11) and additional stenosis (green arrow) further downstream (Figure 12); balloon angioplasty (orange arrow) of the downstream stenosis (Figure 13); and resolution of the stenosis and thrombus (Figure 14); and a diagram of the follow up Duplex Doppler of patent left BCF (Figure 15).

Figure 9

Duplex Doppler of Thrombosed Left Brachiocephalic Fistula

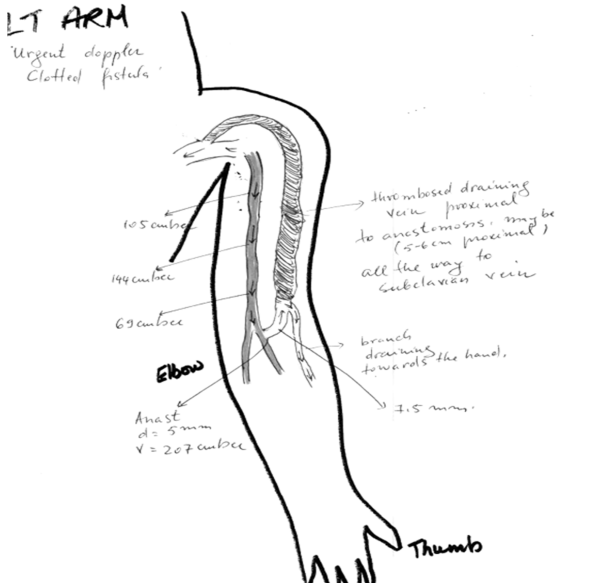
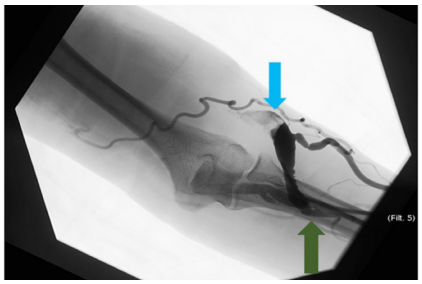


Figure 10

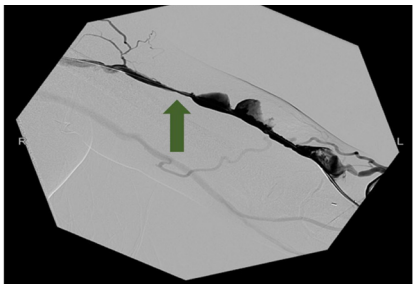
Left BCF with Stenosis at Anastomosis and Thrombosed Segment



Note. Stenosis (green arrow), thrombosed segment (blue arrow)

Figure 11

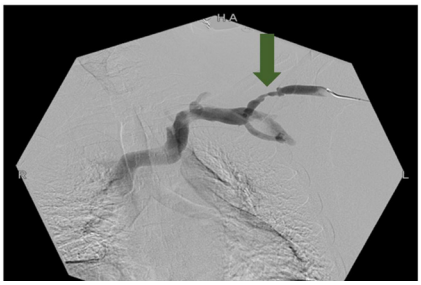
Stenosis in Draining Vein



Note. Stenosis (green arrow)

Figure 12

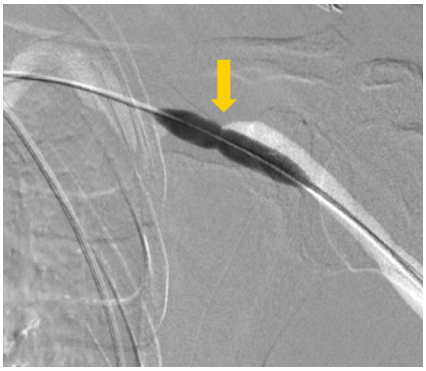
Additional Stenosis Further Downstream



Note. Stenosis (green arrow)

Figure 13

Angioplasty of Downstream Stenosis



Note. Angioplasty site (orange arrow)

Figure 14

Resolution of Stenosis and Thrombus in Left Brachiocephalic Fistula

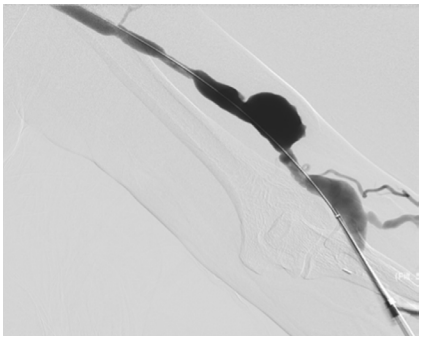
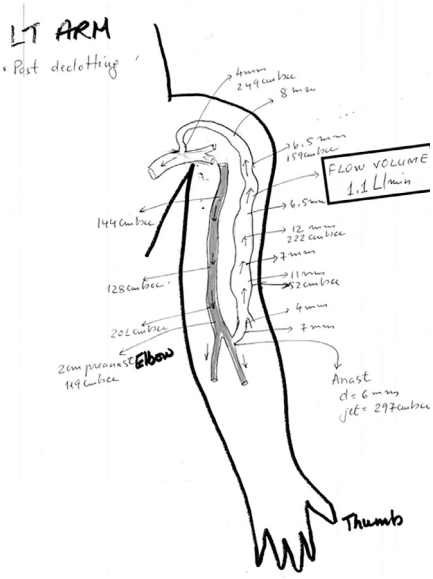


Figure 15

Follow-up Doppler Showing Patent Left BC



Case 3

The third case is a thrombosed left forearm arteriovenous graft (AVG) that was created in October 2015 and underwent a declotting procedure in August 2016. AVGs are more thrombogenic and, therefore, clot more easily. As a result, AVGs require optimal flow immediately after the declotting procedure to remain patent. On the other hand, declotting of AVGs in general is technically easier than fistulas, as the anatomy and the pathology are much more predictable. For example, the graft is a uniform 6 mm in diameter and in almost all cases of thrombosed grafts, the culprit lesion is a stenosis at the venous outflow. Since AVGs are more thrombogenic, the interventional radiologist will attempt to clear all the clots, as even a small amount of residual clot can lead to a re-thrombosed AVG.

AVFs are created from native tissue and inherently non-thrombogenic, and generally more forgiving than AVGs to a small amount of residual clot, especially with adequate intra-procedure heparinization. In cases where there is a small amount of residual clot after the procedure, overnight thrombolysis is generally not recommended by the interventional radiologist. Instead, patients will often receive anticoagulation (subcutaneous or oral) for a few weeks to remove the remaining clots. The Duplex Doppler Ultrasound of the thrombosed left AVG (Figure 16) demonstrates thrombus (brown shade) throughout the entire graft extending from the arterial anastomosis to the venous anastamosis). The stenosis at the venous anastomosis is not detectable or apparent by Doppler as there is no blood flow in the graft.

Initial contrast is injected (fistulogram) that confirms thrombosed (blue arrow) left AVG with no blood flow (Figure 17). The repeat fistulogram demonstrates a stenosis (green arrow) at the venous outflow (Figure 18); balloon angioplasty (orange arrow) at venous outflow (Figure 19); and resolution of the stenosis and thrombus (Figure 20) with restored blood flow (Figure 21); and a diagram of the follow up Duplex Doppler of the patent loop AVG (Figure 22).

Figure 16

Thrombosed Left Arteriovenous Graft

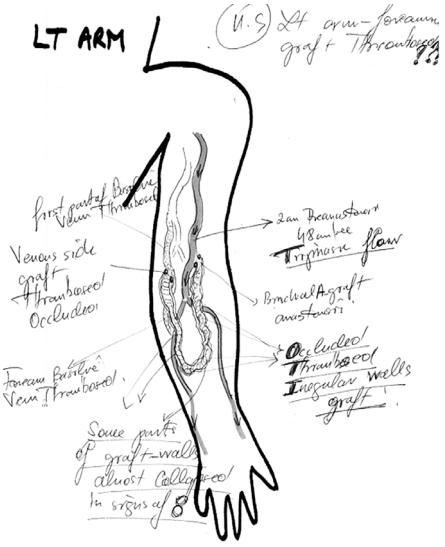
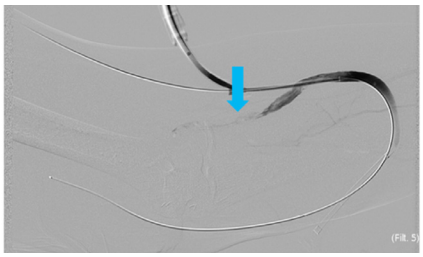


Figure 17

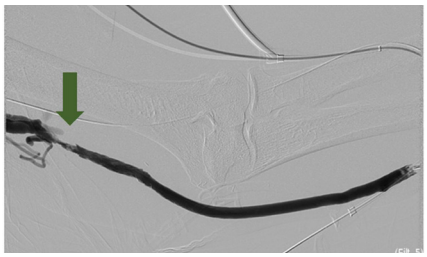
Thrombosed Left AVG



Note. Site of thrombosis (blue arrow)

Figure 18

Stenosis at Venous Anastomosis



Note. Stenosis (green arrow)

Figure 19

Angioplasty of Stenosis at Venous Anastamosis

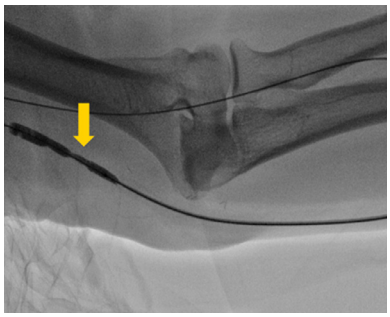


Figure 20

Successful Angioplasty of Venous Anastamotic Stenosis

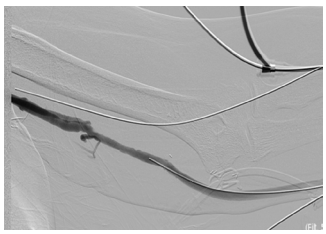


Figure 21

Resolution of Thrombus in Left Arteriovenous Graft

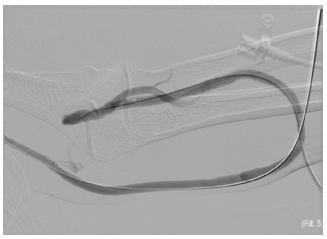
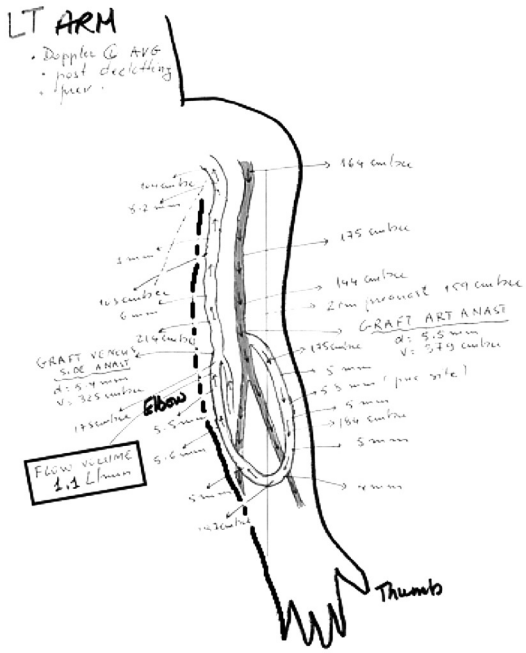


Figure 22

Patent Left Arteriovenous Graft



Case 4

The previous three cases are examples of thrombosed AV accesses that were successfully declotted by the interventional radiologist in one session. However, this is not always the case. The fourth case is a thrombosed left BCF created in June 2020 with a history of multiple previous interventions that required overnight thrombolysis. In cases where there is residual thrombus in the AV access after the declotting procedure and the interventional radiologist deems that there is a high probability AV access will re-thrombose, patients are admitted for overnight pharmacological thrombolysis with heparin and an infusion of Alteplase through a catheter, which is placed at the location of the thrombus.

Overnight pharmacological thrombolysis, in general, has proven to be very effective at our centre for removing any residual clots that are not cleared during the declotting procedure. The following day, patients routinely return to the interventional radiology (IR) suite for a follow-up fistulogram and additional balloon angioplasty (as required) to complete the declotting procedure and, ultimately, improve AV access outcomes.

In this case, the Duplex Doppler ultrasound (Figure 23) demonstrates thrombus (brown shade) extending from the AV anastomosis to the cephalic arch. The stenosis along the cephalic vein were not detectable or apparent on Doppler, as there was no blood flow in the fistula. Initial contrast is injected (fistulogram) that confirms a tight stenosis (green arrow) at the peri-anastamotic and anastamotic area and thrombosed (blue arrow) segment of left BCF (Figure 24); balloon angioplasty of the anastamotic stenosis (Figure 25); residual thrombus (blue arrow) with some restoration of blood flow (Figure 26); and residual thrombus (blue arrow) and small draining vein (Figure 27). Overnight pharmacological thrombolysis demonstrated resolution of the thrombus with restored blood flow (Figure 28); and a follow-up diagram of the Duplex Doppler ultrasound demonstrating a patent left BCF (Figure 29).

Figure 23

Thrombosed Left Brachiocephalic Fistula

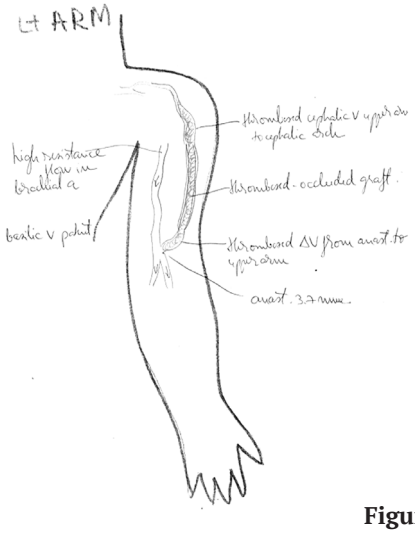
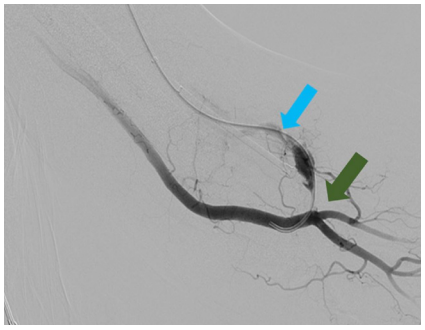


Figure 24

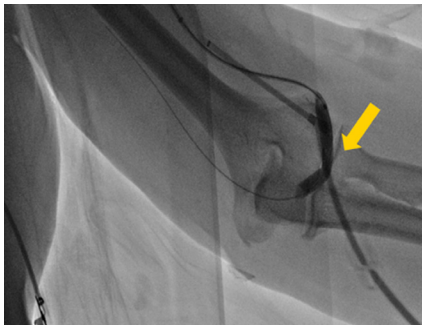
Venogram Confirmation of Stenosis and Thrombosed Segment in Left Brachiocephalic Fistula



Note. Stenosis (green arrow), thrombosed segment (blue arrow)

Figure 25

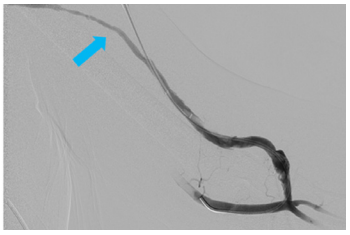
Angioplasty of Perianastamotic and Anastamotic Stenosis



Note. Angioplasty site (orange arrow)

Figure 26

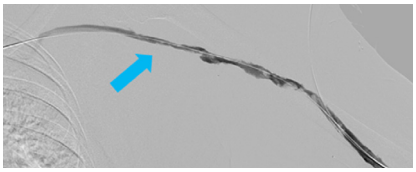
Fistulogram Confirmation of Flow with Residual Thrombus



Note. Residual thrombus (blue arrow)

Figure 27

Residual Thrombus and Small Draining Vein – Overnight Thrombolysis



Note. Residual thrombus (blue arrow)

Figure 28

Fistulogram of Patent Left Brachiocephalic Fistula 24 Hours Post Overnight Thrombolysis

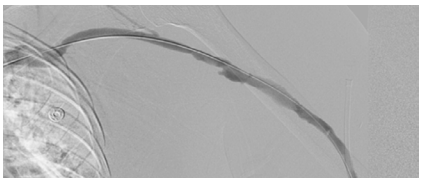
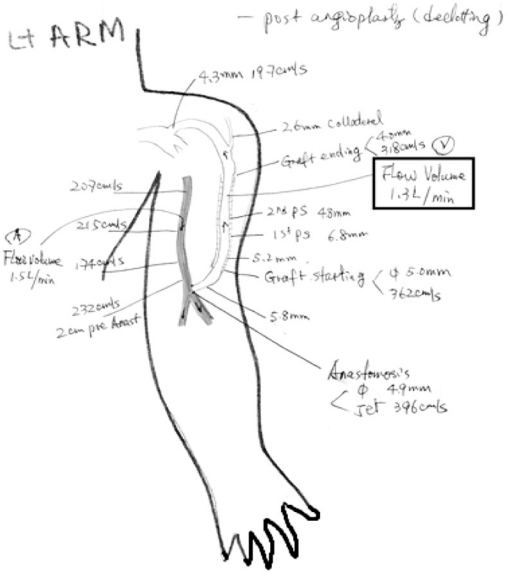


Figure 29

Patent Left BCF



After successful pharmacomechanical thrombolysis is achieved, the treatment with anticoagulation (subcutaneous tinzaparin or warfarin) is determined by the interventional radiologist based on procedural outcomes and in collaboration with the nephrologist and/or nurse practitioner, taking into consideration patient's vascular access history. A follow-up Duplex Doppler ultrasound is routinely scheduled within two weeks after the thrombolysis procedure.

Monitoring and surveillance for patients with recurrent balloon angioplasty or declotting procedures includes serial Duplex Doppler ultrasounds every two to three months and/or monthly access flow monitoring during hemodialysis treatments. Nurses are instructed to monitor AV accesses and promptly report clinical finding such as changes in quality of bruit or thrill, difficulty with cannulation, clots with cannulation or seen with portable ultrasound (Sonosite) assessment, or presence of increased venous or arterial pressures.

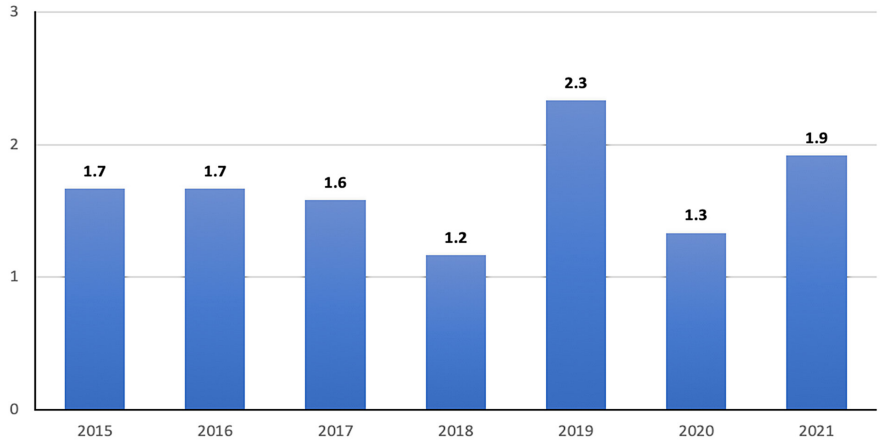
EVALUATION, DATA OUTCOMES, AND ANALYSIS

One hundred and thirty-five procedures were performed during the 81 months between April 2015 and December 2021. Seven patients did not have a procedure and were excluded from the data set. Patient exclusion criteria included patients with large aneurysm(s) or AV access infection, and patients who refused to undergo any intervention. Procedure volumes, wait time (in days), access types, ICU bed availability, post-discharge data, and procedure outcome are provided in Figure 30 to Figure 40.

Data for the average monthly case volume were collected from April 2015 to December 2021 (Figure 30). With the exception of data from 2015 (i.e., April to December), the data collected from 2016 to 2021 show the total number of procedures performed in a full calendar year. There were 135 patients included in the data set, with an average of 1.67 procedures per month (Figure 31). There was no discernable

Figure 30

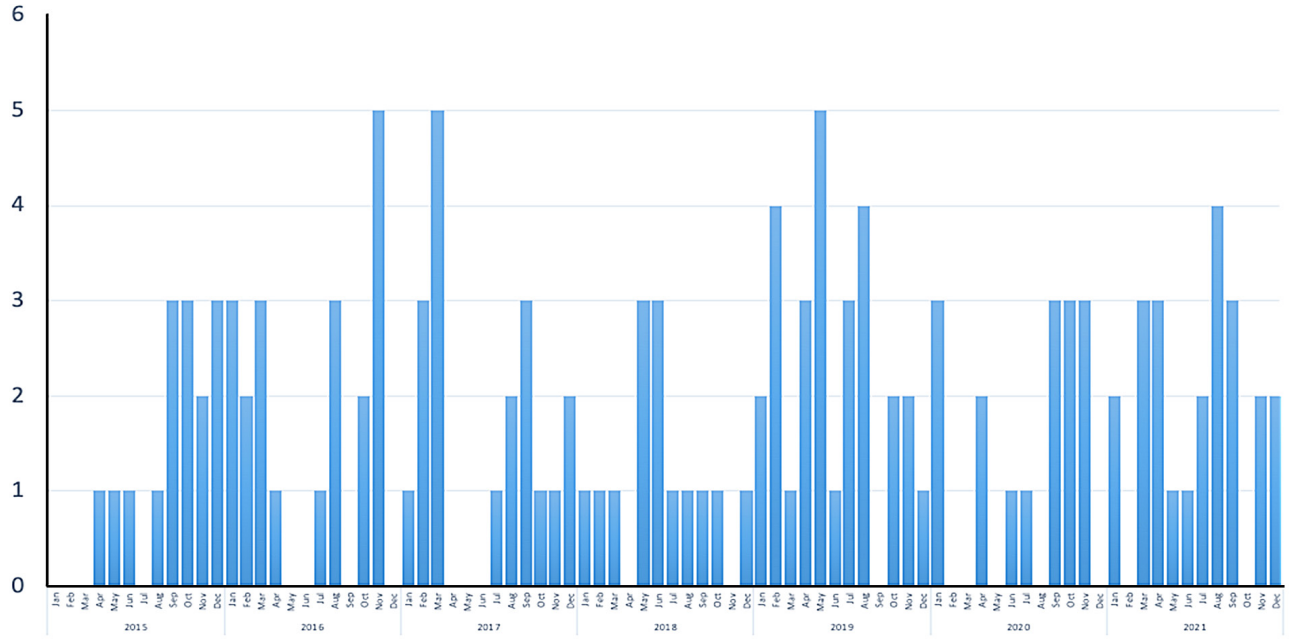
Monthly Average Case Volume by Calendar Year (2015–2021)



Note. From April 2015 to December 2021.

Figure 31

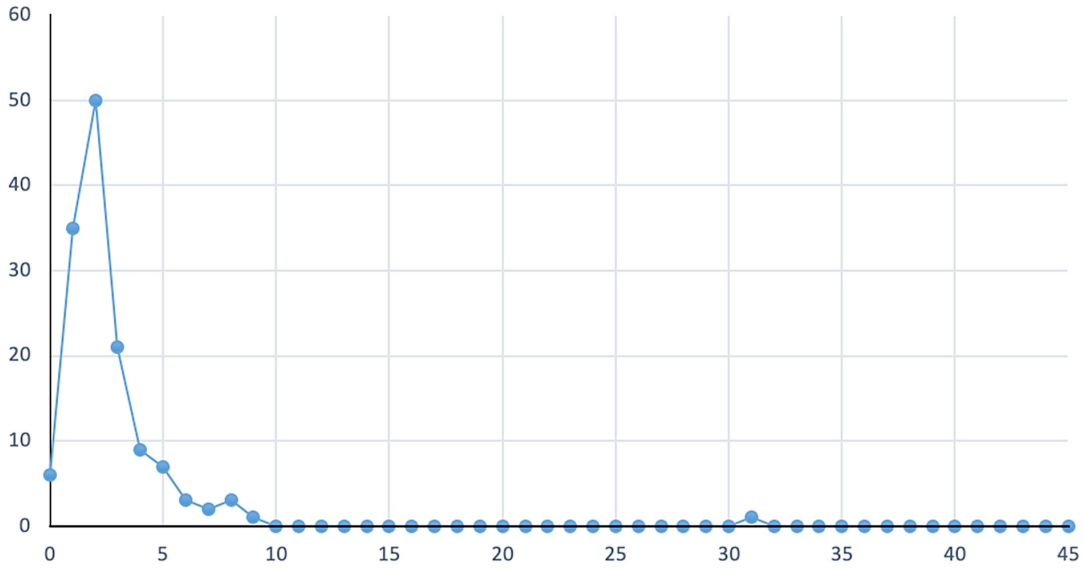
Monthly Procedure Volume



trend observed with a very slight increase in procedure volumes over the data collection period. The greatest number of procedures in any month were five in November 2016, March 2017, and May 2019. Of the 135 procedures, 92.5% were completed within five calendar days (Figure 32), area highlighted in green. The single outlier (31-day mark) represents a patient with a partially thrombosed fistula whose procedure was delayed due to medical instability. The average, median, and 75th, and 90th percentile wait time in days (including the procedure completed 31 days post-access) is calculated from the date the AV access thrombosed to the date the declotting procedure was performed (Figure 33). Excluding the single 31-day outlier shortens the average wait time by 0.21 days (approximately five hours). An ICU bed was available 93.33% of the time, even during the COVID-19 pandemic (Figure 34).

Figure 32

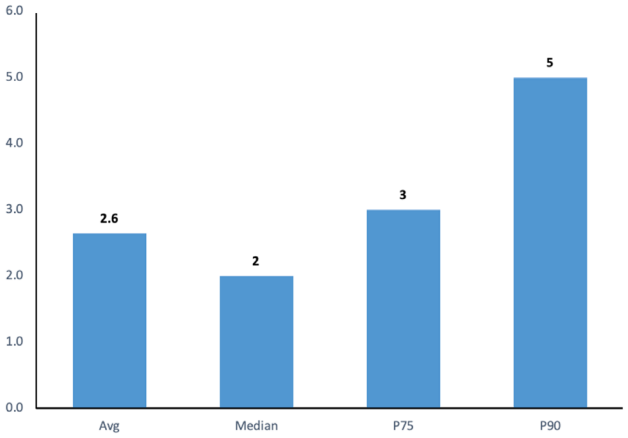
Procedure Volume by Wait Days



Note. Highlighted area indicates that 92.59% of procedures were completed in five calendar days or less (area highlighted in green). The single outlier represents a patient with a partially thrombosed fistula, who underwent declotting at the 31-day mark due to medical instability.

Figure 33

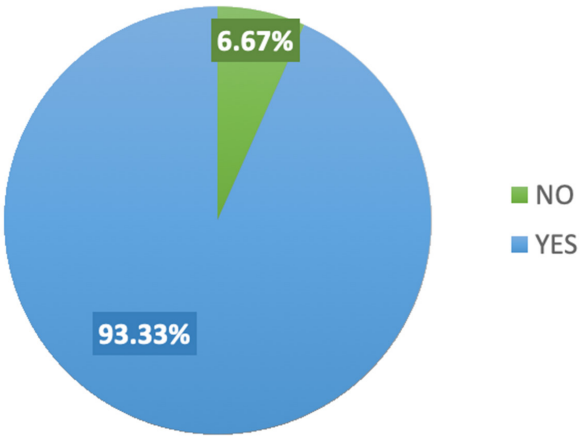
Wait Time in Days



Note. Figure 33 shows the average, median, 75th and 90th percentile wait time in days, including the procedure completed 31 days post-access. Wait time is calculated from the date the AV access thrombosed, to the date of the declotting procedure. Excluding the single 31-day outlier shortens the average wait time by 0.21 days (approximately 5 hours).

Figure 34

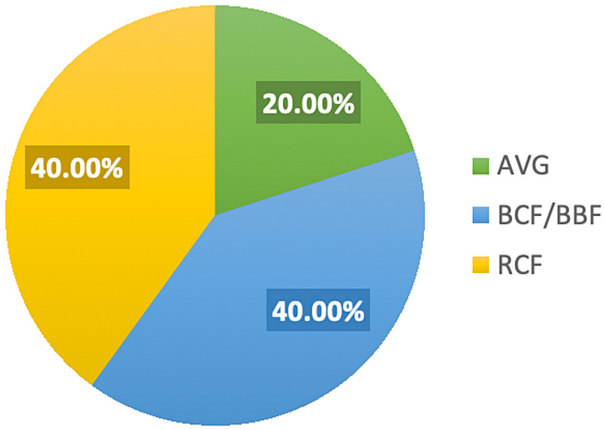
ICU Bed Availability



Post-procedure outcomes, specifically loss of AV accesses, were not negatively affected if an ICU bed was not available. There was an equal distribution of upper (BCF/BBF) and lower (RCF) arm fistulas, with a smaller volume of grafts (AVG) (Figure 35). Among all access types, equal outcomes (losses and successes) were seen in patients with an RCF or a BCF/BBF access (Figure 36). However, measurably better outcomes were evident in patients with an RCF in terms of post-procedure discharge location, with 83.33% of patients recovered in the IR suite regardless of outcome. Unsuccessful outcomes were greatest for patients with an AVG (14.81%), followed by an RCF (12.96%), and then a BCF/BBF (11.11%). AV access loss *and* admission to the ICU were greatest for patients with an AVG and BCF/BBF. Successful outcomes without admission to the ICU were highest for patients with a RCFs (70.37%), followed by an AVG (59.26%), and BCF/BBF (57.41%). Successful outcomes with admission to the ICU were highest for patients with a BCF/BBF (24.07%), followed by an AVG (18.52%), and then RCF (11.11%). A volume summary of the entire data set was collected, grouped by outcome and sorted by access type (Figure 37). These data include procedures that resulted in an adverse event and the seven patients who did not undergo an intervention.

Figure 35

Vascular Access Type



Note. AVG=arteriovenous graft; BCF/BBF=brachiocephalic/brachiobasilic fistula; RCF=radiocephalic fistula.

Figure 36

Percent Outcome by Access Type and Post-Procedure Discharge

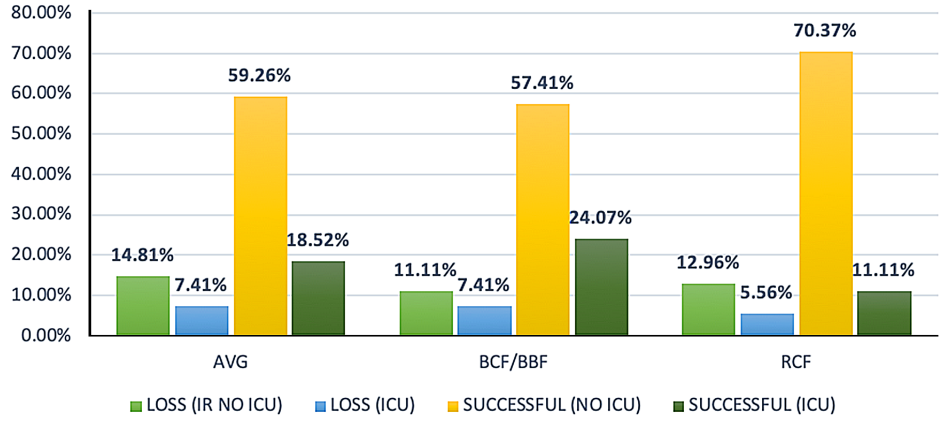
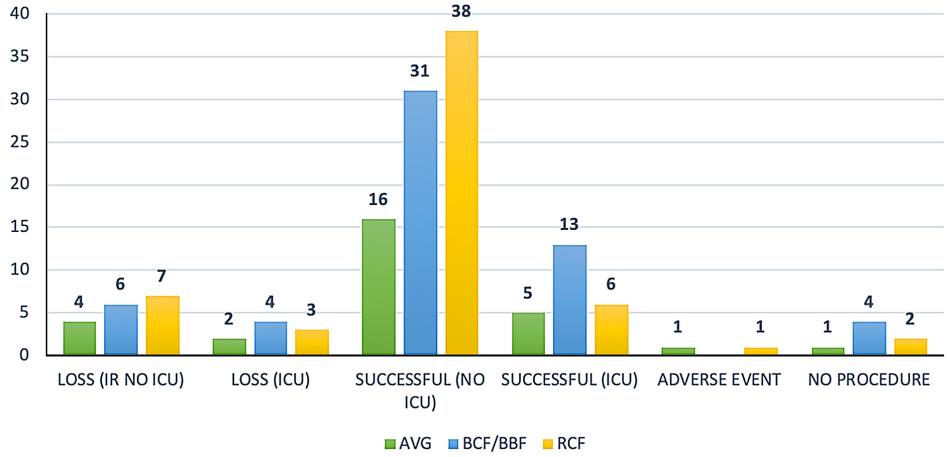


Figure 37

Absolute Outcome by Access Type and Post-Procedure Discharge



Of the 135 patients who underwent declotting procedures, 133 patients (98.52%) completed their procedures without incident and two patients (1.48%) experienced an adverse event (Figure 38). Of the two patients who experienced an adverse event, the first patient's AV access was successfully declotted and the second patient's procedure was unsuccessful. The first patient suffered an allergic reaction to contrast material accompanied by dyspnea and urticaria, and was subsequently admitted to the ICU. The second patient suffered from decreased O_2 saturation levels, shortness of breath, hyperkalemia, and fluid overload. Patients requiring admission to the ICU admission regardless of outcome accounted for 24.44%, including the first patient who experienced an adverse event (Figure 39). The second patient recovered in the IR suite before being transferred to the dialysis unit for hemodialysis treatment.

Figure 38

Adverse Events

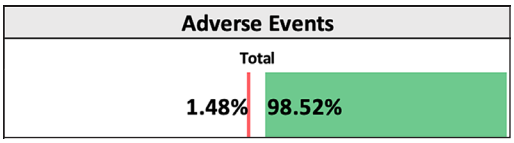
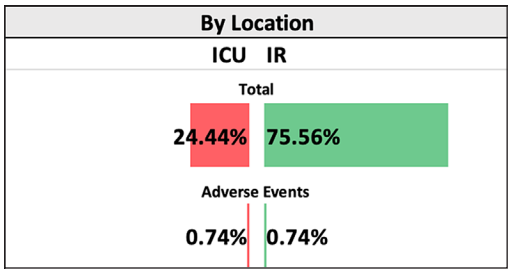


Figure 39

Adverse Events by Location



By Outcome (Loss/Success)

Data were collected including a summary of the total outcome and the distribution of those outcomes by post-procedure discharge location (Figure 40). A total of 80.74% of patients achieved a successful result. As mentioned previously, of the two adverse events previously described, one patient required an ICU admission, and one patient recovered in the IR suite.

By Location and Outcomes (IR and ICU)

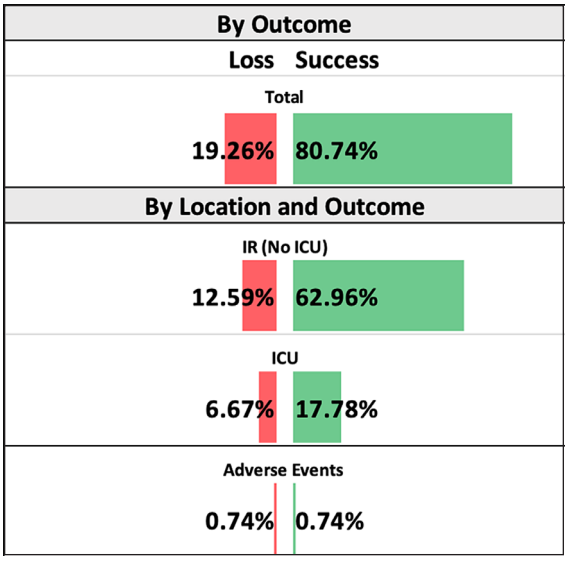
Procedures that resulted in the most favourable outcome, whereby AV accesses was successfully declotted without overnight thrombolysis in the ICU, occurred in 62.96% of procedures. An additional 17.78% of patients AV access were successfully declotted after overnight thrombolysis in the ICU. Of the total number of procedures, 19.26% were unsuccessful (red bars), with 17 patients (12.59%) AV access was deemed not salvageable by the interventional radiologist (i.e., no ICU), based on multiple procedures, age of the access, aneurysm(s), and/or previously failed surgeries.

EVALUATION AND OUTCOMES

There were 135 declotting procedures performed over 81 months with an average of 1.67 procedures a month. The majority of procedures (92.59%) were completed within five days, ICU bed availability was 93.66%, and overnight thrombolysis was performed in 24.44% of cases. Of the cases that underwent overnight thrombolysis, 17.78% were successful, 6.67% were unsuccessful, and lack of bed availability did not result in AV access loss. Successful declotting was achieved in 80.74% of cases, and 19.26% of cases were unsuccessful. Of the 19.26% of cases that were unsuccessful, 12.59% of cases were deemed not salvageable by the interventional radiologist due to multiple procedures, age of access, aneurysms, and failed surgeries. Adverse events were observed in two cases (1.48%); one case with suspected contrast allergy developed urticaria, angioedema and shortness of breath, and the second case developed a decrease in oxygen saturation levels, shortness of breath, hyperkalemia, and fluid overload.

Figure 40

Adverse Events by Outcome, and by Location and Outcome



IMPLICATIONS FOR PRACTICE AND RECOMMENDATIONS

The interventional radiologist can perform declotting procedures faster, better, and safer than other specialties (Quencer & Oklu, 2017), and is able to salvage AV access with excellent technical and clinical success (Shin et al., 2005; Coentrao et al., 2010; Elkharboutly & Raslan, 2016; Alhaizaey et al., 2020). Declotting requires time and patience, and failure is commonly due to operator inexperience, as it is a steep learning curve. For difficult or repeat occlusions, Zaleski (2004) suggests changing the operator, as individual interventional radiologists can have slightly different approaches. Our unique approach with overnight thrombolysis for the treatment of thrombosed AV accesses may be considered by other programs as a strategy to improve AV access patency. Vascular access coordinators are in a strategic position to present this information to hospital administrators and physicians about the vital service that interventional radiologists provide to nephrology patients (Quencer & Oklu, 2017).

REFERENCES

Al-Balas, A., Lee, T., Young, C.J., Kepes, J.A., Barker-Finkel, J., & Allon, M. (2017). The clinical and economic effect of vascular access selection in patients initiating hemodialysis with a catheter. *Journal of American Society of Nephrology, 28,* 3679–3687. https://doi.org/10.1681/ASN.2016060707

Al-Balas, A., Shariff, S., Lee, T., Young, C., & Allon, M. (2019). Clinical outcomes and economic impact of starting hemodialysis with a catheter after predialysis arteriovenous fistula creation. *American Journal of Nephrology, 50,* 221–227. https://doi.org/10.1159/000502050

Al-Barshomy, S. M., El-Antony, N.G., Sakr, M., & El Sokary, R. H. (2021). Epidemiology of central venous catheter infection in hemodialysis patients. *The Egyptian Journal of Hospital Medicine, 82*(2), 225–230. https://doi.org/10.21608/ejhm.2021.142815

Al-Jaishi, A. A., Liu, A. R., Lok, C. E., Zhang, J. C., & Moist, L. (2017). Complications of the arteriovenous fistula: A systematic review. *Journal of American Society of Nephrology, 28*(6), 1839–1850. https://doi.org/10.1681/ASN.2016040412

Alhaizaey, A., Alghamdi, M., Azazy, A., Omran, W., Hamdy, M., Alhazmi, B., & Karmotah, A. (2020). Durability of percutaneous transluminal angioplasty for failing hemodialysis vascular access, retrospective cohort study. *International Journal of Surgery Open, 24*, 185–188. https://doi.org/10.1016/j.ijso.2020.05.006

Allon, M. (2007). Current management of vascular access. *Clinical Journal of American Society of Nephrology, 2*(4), 786–800. https://doi.org/10.2215/CJN.00860207

Bandyk, D. F. (2013). Interpretation of duplex ultrasound dialysis access testing. *Seminars in Vascular Surgery, 26*(2–3), 120–126. https://doi.org/10.1053/j.semvascsurg.2013.12.001

Beathard, G. A. (2002). Physical examination: the forgotten tool. In R. J. Gray & J. J. Sands (Eds.), *Dialysis access: A multidisciplinary approach* (pp. 111-118). Lippincott Williams & Wilkins.

Beathard, G. A., Arnold, P., Jackson, J., Litchfield, T., & Physician Operators Forum of RMS Lifeline (2003). Aggressive treatment of early fistula failure. *Kidney International*, *64*(4), 1487–1494. https://doi.org/10.1046/j.1523-1755.2003.00210.x

Bent, C. L., Sahni, V. A., & Matson, M. B. (2011). The radiological management of the thrombosed arteriovenous dialysis fistula. *Clinical Radiology*, *66*(1), 1–12. https://doi.org/10.1016/j.crad.2010.05.010

Brescia, M.J., Cimino, J.E., Appel, K., & Hurwich, B.J (1966, November). Chronic hemodialysis using venipuncture and a surgically created arteriovenous fistula. *New England Journal of Medicine*, 275, 1089–1092. https://doi.org/10.1056/NEJM19661117275202

Canadian Institute for Health Information. (2016a). *High risk and high cost: Focus on opportunities to reduce hospitalization of dialysis patients in Canada.* Ottawa. https://secure.cihi.ca/free_products/report-corr-high-risk-high-cost-en-web.pdf

Canadian Institute for Health Information. (2016b). *Care in Canadian ICUs.* https://secure.cihi.ca/free_products/ICU_Report_EN.pdf

Canadian Institute for Health Information. (2020). *Cost of a standard hospital stay.* https://yourhealthsystem.cihi.ca/hsp/inbrief?lang=en#!/indicators/015/cost-of-a-standard-hospital-stay-cshs/;mapC1;mapLevel2;province-C9001;trend(C1,C5001);/

Cildag, B. M., & Koseoglu, K. O., (2017). Percutaneous treatment of thrombosed hemodialysis arteriovenous fistulas: Use of thromboaspiration and balloon angioplasty. *Clujul Medical*, *90*(1), 66–70. https://doi.org/10.15386/CJMED-686

Coentrao, L., Bizarro, P., Riberio, C., Neto, R., & Pestana, M. (2010). Percutaneous treatment of thrombosed arteriovenous fistulas: Clinical and economic implications. *Clinical Journal of the American Society of Nephrology*, *5*(12), 2245–2250. https://doi.org/10.2215/CJN.03070410

Collier, S., & Davenport, A. (2014). Reducing the risk of infection in end-stage kidney failure patients treated by dialysis. *Nephrology Dialysis Transplantation*, *29*(12), 2158–2161. https://doi.org/10.1093/ndt/gfu321

Cynamon, J., Lakritz, P. S., Wahl, S.I., Bakal, C. W., & Sprayregen, S. (1997). Hemodialysis graft declotting: Description of the "lyse and wait" technique. *Journal of Vascular and Interventional Radiology, 8*(5), 825–829. https://doi.org/10.1016/s1051-0443(97)70667-5

Cynamon, J., & Pierpont, C. E. (2002). Thrombolysis for the treatment of thrombosed hemodialysis access grafts. *Reviews in Cardiovascular Medicine, 3*(Suppl 2), S84–S91. https://pubmed.ncbi.nlm.nih.gov/12556747/

Dariushnia, S. R., Walker, T. G., Silberzweig, J. E., Annamalai, G., Krishnamurthy, V., Mitchell, J. W., Swan, T. L., Wojak, J. C., Nikolic, B., & Midia, M. (2016). Society of Interventional Radiology Standards of Practice Committee. Quality improvement guidelines for percutaneous image-guided management of the thrombosed or dysfunctional dialysis circuit. *Journal of Vascular and Interventional Radiology*, *27*(10), 1518–1530. https://doi.org/10.1016/j.jvir.2016.07.015

Duque, J. C., Tabbara, M., Martinez, L., Cardona, J., Vazquez-Padron, R. I., & Salman, L.H. (2017). Dialysis arteriovenous fistula failure and angioplasty: Intimal hyperplasia and other causes of access failure. *American Journal of Kidney Diseases, 69*(1), 147–151. https://doi.org/10.1053/j.ajkd.2016.08.025

Elkharboutly, A., & Raslan, M. (2016). Role of interventional radiology in maintaining the vascular access for hemodialysis patients. *Tanta Medical Journal*, *44*(3), 94–101. http://www.tdj.eg.net/

Falk, A., Trerotola, S. O., & Valji, K. (2013). Addressing the clotted access. *Endovascular Today*. https://evtoday.com/articles/2013-june/addressing-the-clotted-access

Ferguson, T. W., Witlock, R. H., Bamforth, R. J., Beaudry, A., Darcel, J., Di Nella, M., Rigatto, C., Tangri, N., & Komenda, P. (2021). Cost-utility of dialysis in Canada: Hemodialysis, peritoneal dialysis, and nondialysis treatment of kidney failure. *Kidney Medicine, 3*(1), 20–30. https://www.kidneymedicinejournal.org/article/S2590-0595(20)30225-9/fulltext

Ghaffarian, A.A., Al-Dulaimi, R., Kraiss, L.W., Sarfati, M., Griffin, C.L., Smith, B.K., Donald, G., & Brooke, B. (2018). Clinical effectiveness of open thrombectomy for thrombosed autogenous arteriovenous fistulas and grafts. *Journal Vascular Surgery*, *68*(1), 189–196. https://doi.org/10.1016/jvs.2017.12.050

Kakkos, S. K., Haddad, G. K., Haddad, J., & Scully, M. M. (2008). Percutaneous rheolytic thrombectomy for thrombosed autogenous fistulae and prosthetic arteriovenous grafts: Outcome after aggressive surveillance and endovascular management. *Journal of Endovascular Therapy*, *15*(1), 91–102. https://doi.org/10.1583/07-2239.1

Koirala, N., Anvari, E., & McLennan, G. (2016). Monitoring and surveillance of hemodialysis access. *Seminars in Interventional Radiology*, *33*(1), 25–30. https://doi.org/10.1055/s-0036-1572548

Kosa, S. D., & Lok, C.E. (2013). The economics of hemodialysis catheter-related infection prophylaxis. *Seminars in Dialysis*, *26*(4), 482–493. https://doi.org/10.1111/sdi.12115

Kotwal, S., Coggan, S., McDonald, S., Talaulikar, G., Cass, A., Jan, S., Polkinghorne, K. R., Gray, N. A., & Gallagher, M. (2020). REDUcing the burden of dialysis Catheter ComplicaTIOns: A National approach (REDUCCTION) - Design and baseline results. *Kidney360*, *1*(8), 746–754. https://doi.org/10.34067/KID.0001132020

Krishna, V. N., Eason, J. B., & Allon, M. (2016). Central vein occlusion in the hemodialysis patient. *American Journal of Kidney Diseases*, *68*(5), 803–807. https://doi.org/10.1053/j.ajkd.2016.05.017

Kumbar, L., Karim, J., & Besarab, A. (2012). Surveillance and monitoring of dialysis access. *International Journal of Nephrology*, *2012*, 649735. https://doi.org/10.1155/2012/649735

Kumpe, D., & Cohen, M. (1992). Angioplasty/thrombolytic treatment of failing and failed hemodialysis access sites: Comparison with surgical treatment. *Progress in Cardiovascular Diseases*, *34*(4), 263–278. https://doi.org/10.1016/0033-0620(92)90021-q

Lee, J., Kim, Y. S., Yoon, S. A., Kim, Y. S., Won, Y. D., Park, S. C., Jang, E. J., & Kim, Y. O. (2013). Retrospective review of angiography before cannulation of newly created vascular accesses in hemodialysis patients. *Journal of Vascular and Interventional Radiology*, *24*(9), 1309–1315. https://doi.org/10.1016/j.jvir.2013.04.035

Leivaditis, K., Panagoutsos, S., Roumeliotis, A., Liakopoulos, V., & Vargemezis, V. (2014, February). Vascular access for hemodialysis: Postoperative evaluation and function monitoring. *International Urology and Nephrology*, *46*(2), 403–409. https://doi.org/10.1007/s11255-013-0564-2

Lok, C. E., Huber, T. S., Lee, T., Shenoy, S., Yevzlin, A. S., Abreo, K., Allon, M., Asif, A., Astor, B. C., Glickman, M. H., Graham, J., Moist, L. M., Rajan, D. K., Roberts, C., Vachharajani, T. J., Valentini, R. P., & National Kidney Foundation. (2020). KDOQI clinical practice guideline for vascular access: 2019 update. *American Journal of Kidney Diseases*, *75*(4 Suppl 2), S1–S164. https://doi.org/10.1053/j.ajkd.2019.12.001

MacRae, J. M, Dipchand, C., Oliver, M., Moist, L., Lok, C., Clark, E., Hiremath, S., Kappel, J., Kiaii, M., Luscombe, R., & Miller, L. M. (2016). Arteriovenous access failure, stenosis, and thrombosis. *Canadian Journal of Kidney Health and Disease*, *3*, 2054358116669126. https://doi.org/10.1177/2054358116669126

Mehta, S. (1991). Statistical summary of clinical results of vascular access procedures for hemodialysis. In H. M. Somner (Ed.), *Vascular Access for Hemodialysis (part II)* (pp. 145–155). Chicago Precep Press.

Mudoni, A., Cornacchiari, M., Gallieni, M., Guastoni, C., McGroggan, D., Logias, F., Ferramosca, E., Mereghetti, M., & Inston, N. (2015). Aneurysms and pseudoaneurysms in dialysis access. *Clinical Kidney Journal*, *8*(4), 363–367. https://doi.org/10.10/ckj/sfv042

National Aeronautics and Space Administration (NASA). (n.d.). Bernoulli's principle. https://www.nasa.gov/sites/default/files/atoms/files/bernoulli_principle_k-4.pdf

Pietura, R., Janczarek, M., Zaluska, W., Szymanska, A., Janicka, L., Skublewska-Bednarek, A., & Szczerbo-Trojanowska, M. (2005). Color doppler ultrasound assessment of well-functioning mature arteriovenous fistulas for haemodialysis access. *European Journal of Radiology, 55*(1), 113–119. https://doi.org/10.1016/j.ejrad.2004.09.010

Poulain, F., Raynaud, A., Bourquelot, P., Knight, C., Rovani, X., & Gaux, J. C. (1991). Local thrombolysis and thromboaspiration in the treatment of acutely thrombosed arteriovenous hemodialysis fistulas. *Cardiovascular and Interventional Radiology*, *14*(2), 98–101. https://doi.org/10.1007/BF02577703

Quencer, K. B., & Friedman, T. (2017). Declotting the thrombosed access. *Techniques in Vascular and Interventional Radiology*, *20*(1), 38–47. https://doi.org/10.1053/j.tvir.2016.11.007

Quencer, K. B., & Oklu, R. (2017). Hemodialysis access thrombosis. *Cardiovascular Diagnosis & Therapy*, *7*(Suppl 3), S299–S308. https://doi.org/10.21037/cdt.2017.09.08

Quinan, P., & Sutherland, K. for the Canadian Hemodialysis Access Coordinators, Appleton, D., Duteau, J., Pritchard, L., Wile, C., Astle, C., Bachynski, J., Thibeault, I., Thomas, A., & Wile, C. (2015). Nursing recommendations for the management of vascular access in adult hemodialysis patients: 2015 update. *Canadian Association of Nephrology Nurses and Technologists Journal*, *25*(Suppl 1), S3–45.

Rajan, D. K., Clark, T. W., Patel, N. K., Stavropoulos, S. W., & Simons, M. E. (2003). Prevalence and treatment of cephalic arch stenosis in dysfunctional autogenous hemodialysis fistulas. *Journal of Vascular and Interventional Radiology*, *14*(5), 567–573. https://doi.org/10.1097/01.rvi.0000071090.76348.bc

Ravani, P., Palmer, S. C., Oliver, M. J., Quinn, R. R., MacRae, J. M., Tai, D. J., Pannu, N. I., Thomas, C., Hemmelgarn, B. R., Craig, J. C., Manns, B., Tonelli, M., Strippoli, C., & James, M. T. (2013). Associations between hemodialysis access type and clinical outcomes: A systematic review. *Journal of American Society of Nephrology*, *24*(3), 465–473. https://doi.org/10.1681/ASN.2012070643

Richard, C. J. (2011). Preservation of vascular access for hemodialysis in acute care settings. *Critical Care Nursing Quarterly*, *34*(1), 76–83. https://doi.org/10.1097/CNQ.0b013e3182048ca4

Sands, J., Patel, S., Plaviak, D., & Miranda, C. (1994). Pharmacomechanical thrombolysis with urokinase for treatment of thrombosed hemodialysis access grafts: A comparison with surgical thrombectomy. *ASAIO Journal*, *40*(3), M866–M888. http://doi.org/10.1097/00002480-199407000-00123

Schmidli, J., Widmer, M. K., Basile, C., de Donato, G., Gallieni, M., Gibbons, C. P., Haage, P., Hamilton, G., Hedin, U., Kamper, L., Lazarides, M. K., Lindsey, B., Mestres, G., Pegoraro, M., Roy, J., Setacci, C., Shemesh, D., Tordoir, J., & van Loon, M., ESVS Guidelines Committee, … Roca-Tey, R. (2018). Editor's choice - Vascular access: 2018 clinical practice guidelines of the European Society for Vascular Surgery (ESVS). *European Journal of Vascular and Endovascular Surgery*, *55*(6), 757–818. https://doi.org/10.1016/j.ejvs.2018.02.001

Semaan, D., Warren M.W., Vance, L.M., Watha, J., & Croake, A. (2015, February). Dialysis fistula/graft declotting and interventions: Who does it better? Comparing long-term patency rates in a community setting. *Journal of Vascular and Interventional Radiology, 26*(2), Supplement, S14–S15. https://doi.org/10.1016/j.jvir.2014.12.045

Shin, S. W., Do, Y. S., Choo, S. W. Lieu, W. C., & Choo, I. W. (2005). Salvage of immature arteriovenous fistulas with percutaneous transluminal angioplasty. *Cardiovascular Interventional Radiology, 28*, 434–438. https://doi.org/10.1007/s00270-003-0211-x

Smits, J. H, van der Linden J, Blankestijn P. J, & Rabelink T. J. (2000). Coagulation and haemodialysis access thrombosis. *Nephrology Dialysis Transplantation. 15*(11), 1755–1760. https://doi.org/10.1093/ndt/15.11.1755

Teodorescu, V., Gustason, S & Schanzer, H. (2012). Duplex ultrasound evaluation of hemodialysis access: A detailed protocol. *International Journal of Nephrology*, *2012*, 508956. https://doi.org/10.1155/2012/508956

Trerotola, S., Lund, G., Scheel, P., Savader, S., Venbrux, A., & Osterman, F. (1994). Thrombosed hemodialysis access grafts: Percutaneous mechanical declotting with urokinase. *Radiology*, *191*(3), 721–726. https://doi.org/10.1148/radiology.191.3.8184052

Turmel-Rodrigues, L., Pengloan, J., Rodrigue, H., Brillet, G., Lataste, A., Pierre, D., Jourdan, J. L., & Blanchard, D. (2000). Treatment of failed native arteriovenous fistulae for hemodialysis by interventional radiology. *Kidney International*, *57*(3), 1124–1140. https://doi.org/10.1046/j.1523-1755.2000.00940.x

Valji, K., Bookstein, J. J., Roberts, A. C., Oglevie, S. B., Pittman, C., & O'Neill, M. P. (1995). Pulse-spray pharmacomechanical thrombolysis of thrombosed hemodialysis access grafts: Long-term experience and comparison of original and current techniques. *American Journal of Roentgenology*, *164*(6), 1495–1503. https://doi.org/10.2214/ajr.164.6.7754901

Vorwerk, D., Sohn, M., Schurmann Hoogeveen, Y., Gladziwa, U., & Guenther, R. (1994). Hydrodynamic thrombectomy of hemodialysis fistulas: First clinical results. *Journal of Vascular Interventional Radiology*, *5*, 813–821. https://doi.org/10.1016/S1051-0443(94)71611-0

Vorwerk, D., Schurmann, K., Müller-Leisse, C., Adam, G., Bücker, A., Sohn, M., Kierdorf, H., & Günther, R. W. (1996). Hydrodynamic thrombectomy of haemodialysis grafts and fistulae: Results of 51 procedures. *Nephrology Dialysis Transplantation*, *11*(6), 1058–1064.

Whittier, W.L. (2009) Surveillance of hemodialysis vascular access. *Seminars in Interventional Radiology*, *26*(2), 130-138. https://doi.org/10.1055/s-0029-1222457

Winkler, T. A., Trerotola, S. O., Davidson, D. D., & Milgrom, M. L. (1995). Study of thrombus from thrombosed hemodialysis access grafts. *Radiology*, *197*(2), 461–465. https://doi.org/10.1148/radiology.197.2.7480694

Zaleski, G. (2004). Declotting, maintenance, and avoiding procedural complications of native arteriovenous fistulae. *Seminars in Interventional Radiology*, *21*(2), 83–93. https://doi.org/10.1055/s-2004-833681

CONTACT HOUR: 2.0 HRS

Evaluating the safety of common herbal supplements in chronic kidney disease, dialysis, and kidney transplant patients

By Nathaniel Lee and Marisa Battistella

LEARNING OBJECTIVES

1. Describe the use and safety concerns of common herbal supplements in chronic kidney disease (CKD), dialysis, and kidney transplant patients.
2. List and discuss potential drug-herb interactions.
3. Identify tools and available resources to evaluate herbal supplement safety profiles in CKD.

BACKGROUND

Herbal supplements are widely used and remain a popular complementary alternative medicine (KDIGO, 2013; Hassen et al., 2022). A 2017 study that evaluated the prevalence of herbal supplement use in a large population of US adults demonstrated that more than a third of the study participants used at least one herbal medicine (Rashrash et al., 2017). Herbal supplement use in chronic kidney disease (CKD), dialysis, or transplant patients is also prevalent. One study found that 18.6% of CKD and post-transplant patients in several nephrology clinics in Isafahan, Iran, were using herbal supplements (Mohammadi et al., 2020). Another study in three outpatient nephrology clinics and dialysis centres in Egypt demonstrated that greater than 40% of patients with CKD and dialysis, or transplant recipients, used herbal and natural products (Osman et al., 2015). Multiple studies have proposed that patients with CKD or receiving dialysis may be more concerned about their health due to their generally poor quality of life and seek alternative medical approaches at a higher rate (Rashrash et al., 2017; Mohammadi et al., 2020).

Despite the prevalence of herbal supplement use, healthcare providers are generally unaware of alternative treatment modalities that could be impacting patients' health (Mohammadi et al., 2020). A Turkish study revealed that only 12.5% of patients with CKD reported herbal consumption to their physicians (Mohammadi et al., 2020; Kara, 2009). One reason for the lack of transparency may be due to disapproval for complementary alternative medicine (Mohammadi et al., 2020; Birdee et al., 2013; Blackmer & Jefromova, 2002).

Herbal supplements as a whole do not have good quality safety or efficacy data, and some are known to adversely affect CKD and kidney transplant patients through electrolyte changes, pharmacokinetic interactions, effects on the immune system or production of toxic metabolites (KDIGO, 2013; Rashrash et al., 2017; Hassen et al., 2022; Mohammadi et al., 2020; Dahl, 2001). Herbal supplements that contain aristolochic acid, for example, are known to be nephrotoxic through several mechanisms including apoptosis, oxidative stress, and inflammation (KDIGO, 2013; Anger et al., 2020; Ji et al., 2021). Common supplements that contain aristolochic acid include *guang fang ji* (Aristolochia fangchi), chocolate vine, *mu tong* (Akebia), *xi xin* (Asarum), *chuan mu tong* (Clematis), *wei ling xian* (Clematis chinennsis), and *han fang ji* (Stephania) (Brown, 2017). Aristolochic acid may often be found as an additive in other typically unregulated herbal supplements, which poses an added risk when herbal supplements are taken and are not rigorously tested before they are distributed (Audimoolam & Bhandari, 2006; Brown, 2017). Noni is another herbal supplement that is used commonly by patients and can be potentially dangerous for patients with kidney impairment. Juice made of noni contains a significant amount of potassium: about 6 mEq per 100 mL of juice according to one case report (Mueller et al., 2000). It can, thereby, cause large shifts of

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potassium and increase the risk of hyperkalemia (Mueller et al., 2000; Natural Medicines, 2022a).

Herbal supplements may also have serious drug interactions leading to adverse health outcomes. Since many patients with CKD, on dialysis, or who have had a kidney transplant often take multiple prescription medications for several different conditions, herbal supplements may pose a potential threat to a patient's health, either through direct effects or interactions with prescription medications (Mohammadi et al., 2020; Markell, 2005; Akyol et al., 2011; Nowack et al., 2009). As such, herbal remedies are not recommended to be used in people with CKD (KDIGO, 2013).

All of these issues highlight the importance of considering the potential impact of herbal supplements in the health and management of patients, especially those who may be more vulnerable such as those with CKD, receiving dialysis, or have had kidney transplant, or in patients who express a strong desire to use herbal supplements. The healthcare team therefore plays a pivotal role in assessing if herbal supplement use is safe and appropriate as well as promoting an open and welcoming discussion with patients to ensure all facets of healthcare are considered. Common herbal supplements used in the community will be discussed in the context of their current safety profile in CKD, dialysis, and kidney transplant patients, which will provide a framework for how to evaluate and assess their safety in these patients.

ST. JOHN'S WORT

St. John's wort is a popular herbal supplement that is commonly made into oral or topical formulations. It may be used by patients for a variety of conditions or reasons, although it has been only shown to be likely effective for depression and possibly effective in reducing menopausal symptoms or symptoms of somatization disorder (Natural Medicines, 2022b). Although oral St. John's wort is generally well tolerated, its concerns for use in patients with kidney dysfunction stem from a limited number of case reports, its elimination pathway, and its numerous drug interactions. In one case, a 46-year-old female developed acute kidney injury (AKI) after ingesting a tea made with St. John's wort. She subsequently had acute kidney failure and required three hemodialysis sessions to recover (Natural Medicines, 2022b; Adibelli et al., 2021). Some of the active ingredients of St. John's wort are primarily eliminated by the kidneys, which also raises concerns for its use in patients with kidney impairment, as impaired renal elimination could lead to accumulation and adverse effects (Burrowes & Van Houten, 2006; Duncan, 1999). There are no current data that demonstrate St. John's wort is safe to use in dialysis patients.

Last, St. John's wort has a plethora of drug interactions that would further merit a strong advisory against using it, especially since patients with CKD, receiving dialysis, and who have had a kidney transplant typically use multiple medications that have a high probability of interacting with St. John's wort. Notable common medications prescribed in CKD and dialysis that can interact with St. John's wort include clopidogrel, digoxin, HMG-CoA reductase inhibitors (statins), omeprazole, oxycodone, rivaroxaban, tramadol, and warfarin (Natural Medicines, 2022b). Of note, in regard to kidney transplant patients, St. John's wort is known to interact with immunosuppressant medications. Organ transplant rejection occurred in numerous case reports and clinical trials when St. John's wort was combined with cyclosporine, as St. John's wort increased cyclosporine clearance through induction of CYP3A4 and P-glycoprotein/MDR-1 (Borrelli & Izzo, 2009; Mandelbaum et al., 2000; Mai et al., 2000; Barone et al., 2000; Bauer et al., 2003; Brown, 2017). This led to acute transplant rejection in patients with heart, liver, or kidney transplants (Barone et al., 2000; Bauer et al., 2003; Breidenbach et al., 2000; Brown, 2017). Similarly, St. John's wort interacts and decreases serum levels of the immunosuppressive drug tacrolimus, which can pose a risk of organ rejection (Mai et al., 2003). These drug interactions are evidence for kidney transplant patients to clearly avoid using St. John's wort.

ECHINACEA

Echinacea is a common herbal supplement that is possibly effective when used to prevent and manage symptoms of the common cold (Burrowes & Van Houten, 2006; Natural Medicines, 2022c). It is generally well tolerated when taken orally and at recommended doses (Natural Medicines, 2022c). In CKD and dialysis patients, safety evidence about echinacea is limited. In one case report, a 36-year-old female who took a mix of supplements including echinacea, St. John's wort, and kava for two weeks, subsequently developed muscle weakness, hypocalcemia, hypophosphatemia, critical hypokalemia (K+ 1.3), renal tubular acidosis, fatigue, and dry mouth and eyes. This particular patient was diagnosed with Sjogren's syndrome, an autoimmune disease thought to have been triggered by echinacea's immunostimulant effects, and this ultimately resulted in her kidney complications (Logan & Ahmed, 2003; Brown, 2017; Natural Medicines, 2022c). Additionally, there was one case of acute kidney failure out of 51 adverse reaction reports linked to echinacea use in Australia in a single year (Mullins & Heddle, 2002). An important conclusion from these case reports is that echinacea's nephrotoxic adverse events, although rare, is probable in a large population of patients who take echinacea in unsupervised and non-standardized formulations (Mullins & Heddle, 2002). There are also no data that supports safe echinacea use in patients receiving dialysis. In this way, the potential benefits of echinacea use in CKD or dialysis patients should be heavily scrutinized and weighed against its potential risks, or it should be avoided altogether if possible.

For kidney transplant patients, echinacea should absolutely be avoided, despite a lack of evidence. It is theorized by various studies that echinacea can interfere with immunosuppressant therapy such as cyclosporine and mycophenolate through the various mechanisms it can stimulate the immune system (Mohammadi et al., 2020; Natural Medicines, 2022c; Barrett, 2003; Shi & Klotz, 2012; Staines, 2011). In turn, this could lead to kidney graft rejection (Mohammadi et al., 2020). This is a serious potential adverse health outcome that can easily be prevented by avoiding echinacea herbal supplements in kidney transplant patients.

GINKGO BILOBA

Ginkgo biloba, which comes from ginkgo leaf extracts of large trees with fan-shaped leaves native to Asia, but can be seen in many other parts of the world including Canada now, is a popular supplement used for a variety of conditions. It is noted to have possible effectiveness for reducing anxiety, symptoms of schizophrenia, severity of tardive dyskinesia, and improving hearing loss, recovery from stroke, symptoms of premenstrual syndrome, and vertigo. Ginkgo is available as a variety of formulations, including intravenous, intramuscular, topical, ophthalmic, and oral, although the oral formulation is much more common and is mostly well tolerated when used at recommended doses (Natural Medicines, 2022d). There is limited and conflicting evidence for ginkgo's safety in patients with any kidney impairment. Li and colleagues (2019) examined the in vitro and in vivo effects of the bioflavonoids from ginkgo biloba. The in vitro human kidney tubular epithelial cells demonstrated reduced cell viability in a dose-dependent manner from the bioflavonoids, indicating potential kidney toxicity. In vivo experiments in mice showed that bioflavonoid administration of 20 mg/kg/day for seven days resulted in significantly increased alkaline phosphatase activity and acute kidney injury. In this study, ginkgo bioflavonoids also cause hepatic toxicity, suggesting the other potential health risks of using this herbal supplement. Various other researchers have investigated ginkgo's use in improving a variety of complications associated with CKD. These have included a potential to alleviate vascular calcification, slow down progression of hypertensive nephropathy and improve kidney in these patients, as well as reduce tubular damage in diabetic kidney disease (Wang et al., 2019; Jialiken et al., 2021; Han et al., 2021; Yu et al., 2021; Welt et al., 2007; Wang et al., 2020). Jialiken et al.'s study was focused on humans; however, ginkgo therapy was combined with conventional anti-hypertensive therapy and thus ginkgo's effect on hypertensive nephropathy remains still uncertain. Interestingly, ginkgo has been studied to show a potential to protect against nephrotoxicity from various medications such as gentamicin and methotrexate in rats (Naidu et al., 2000; Sherif et al., 2019). Thus, in CKD patients, ginkgo should be avoided to prevent possible nephrotoxicity.

In peritoneal dialysis patients, ginkgo was being safely used at 160 mg/day for 8 weeks (Kim et al., 2005). Another study used ginkgo in hemodialysis patients; however, no safety outcomes were reported from it (Huang et al., 2008). There is also conflicting evidence that ginkgo can increase bleeding risk in patients who take antiplatelets, anticoagulants, or ibuprofen as it may have antiplatelet effects itself (Natural Medicines, 2022d). This may pose a problem in dialysis patients who are at an increased risk of bleeding due to platelet dysfunction. It therefore may be safe to use ginkgo in dialysis patients, although data is limited, and any use should be monitored with extreme caution and evaluated in terms of dosing, formulation, bleed risks and patient-specific factors. Additionally, Hauser and colleagues (2002) described a patient with a case of subphrenic hematoma occurring one week after a second liver transplantation due to postoperative ginkgo use. There were no further bleeding episodes after the ginkgo supplement use was discontinued. Aside from this evidence that suggests ginkgo should be avoided around the time of surgery due to its potential to increase bleeding, there are few pieces of evidence to demonstrate explicitly that ginkgo is unsafe in kidney transplant patients. Unlike the other herbal supplements, ginkgo has not been reported to interact with immunosuppressants. Given the paucity of data, however, it would be safest to avoid ginkgo supplement use in these patients.

GLUCOSAMINE

Glucosamine is a widely used supplement for osteoarthritis, although there are conflicting viewpoints and evidence as to whether it is effective. Glucosamine is generally made using the chitin in the shells of shellfish, which may already pose a risk to those with shellfish allergies (Murray, 2012; Heller, 2008; Natural Medicines, 2022e). However, there are glucosamine products made from fungus or corn (Heller, 2008; Natural Medicines, 2022e). It is generally combined with other supplements such as chondroitin and methylsulfonylmethane (MSM), both of which are also used for osteoarthritis and joint health. Some glucosamine capsules contain potassium chloride to stabilize the product, which can additionally raise problems in patients with potassium-restricted diets, such as those with CKD or receiving dialysis (Wangroongsub et al., 2010; Natural Medicines, 2022e).

One major drug interaction of glucosamine is warfarin. It is thought that glucosamine has weak antiplatelet activity, and it has been shown in multiple case reports that concomitant use leads to increased INR and bleeding risk (Knudsen & Sokol, 2008; Yue et al., 2006; Rozenfeld et al., 2004; Danao-Camara, 2000; Natural Medicines, 2022e). At recommended oral doses, glucosamine is usually well tolerated. Similar to St. John's wort, the major pathway of elimination for glucosamine is through the kidneys. This means its elimination may be delayed in CKD patients (Natural Medicines, 2022e). Clinical trial data in healthy, non-CKD patients have suggested no nephrotoxic effects of glucosamine (Reginster et al., 2001; Pavelka et al., 2002; Natural Medicines, 2022e). Other case reports have indicated potential nephrotoxicity with glucosamine use. In one study, out of 200 patients with osteoarthritic pain who took combination glucosamine and chondroitin, there were four cases of 1+ to 2+ proteinuria, and three patients with elevated creatinine phosphokinase level that was reversible (Danao-Camara, 2000). In another case, a 79-year-old patient taking glucosamine for several months had elevated blood urea nitrogen and creatinine levels without proteinuria that gradually returned to normal once the patient discontinued glucosamine. This patient was also noted to take cyclosporine concurrently, which may have had an additive nephrotoxic effect (Guillaume & Peretz, 2001. There have been cases of acute tubulointerstitial nephritis reported as well (Audimoolam & Bhandari, 2006; Gueye et al., 2016). Gueye and colleagues observed a reduction in glomerular filtration rate (GFR) from 86 to 47 mL/min/1.73m2 within three months with non-inflammatory

fibrosis of the renal cortex in a patient who took glucosamine 1,200 mg daily for three years. The patient's kidney function improved from 47.5 to 60 mL/min/1.73m^2 after glucosamine was discontinued. However, after the patient restarted glucosamine, there was repeated loss in kidney function from 60 to 53 mL/min/1.73m^2 after three weeks (Gueye et al., 2016). Due to the potential for nephrotoxic effects and delayed elimination, glucosamine is not recommended for all CKD and kidney transplant patients if possible. Although glucosamine is thought to be mostly renally eliminated, given conflicting evidence about its effectiveness, its potential to increase bleed risk and no current data supporting safe use in dialysis, patients receiving dialysis may use glucosamine with caution, and its efficacy and side-effects should be monitored.

OTHER RESOURCES

The herbal supplements discussed in this article are only a few of the most commonly used in the community. As there are many other supplements available, and as more studies and case reports are published, it is imperative to know appropriate resources and tools to keep up with current evidence and guidelines. Table 1 is a helpful list of tools and resources that can help in researching herbal supplements and providing up-to-date evidence to help determine whether they are safe to use in patients. HerbalCKD.com, a Canadian website, is a useful tool to find information about natural health products and their use specifically in CKD, dialysis, and kidney transplant patients.

Table 1

Tools and Resources for Herbal Supplement Information

- HerbalCKD.com
  https://www.herbalckd.com
- Natural Medicines
  https://naturalmedicines.therapeuticresearch.com/
- National Kidney Foundation
  https://www.kidney.org/
  https://www.kidney.org/atoz/content/herbalsupp
  https://kidneyhi.org/use-of-herbal-supplements-in-chronic-kidney-disease/
  https://kidneyhi.org/dietitian-blog/herbal-supplements-and-chronic-kidney-disease/
- Healthcare professionals such as pharmacists and dietitians

CONCLUSION

Herbal supplements are popular and will continue to be used by many patients including those with CKD, receiving dialysis, or who have had kidney transplants. Despite this, data and evidence supporting safety of herbal supplements remain limited in these populations. It is, therefore, important to gather a comprehensive patient history and consult resources available on the herbal supplement in order to make sound clinical judgement. The risks and benefits of continuing a herbal supplement should be weighed to ensure patient safety.

REFERENCES

Adibelli, Z., Karacay, I., Demir, M., & Duran, C. (2022). St. John's wort (Hypericum perforatum)-related acute kidney injury. *Blood purification*, *51*(6), 520–522. https://doi.org/10.1159/000518349

Akyol, A. D., Yildirim, Y., Toker, E., & Yavuz, B. (2011). The use of complementary and alternative medicine among chronic renal failure patients. *Journal of Clinical Nursing*, *20*(7-8), 1035–1043. https://doi.org/10.1111/j.1365-2702.2010.03498.x

Anger, E. E., Yu, F., & Li, J. (2020). Aristolochic acid-induced nephrotoxicity: Molecular mechanisms and potential protective approaches. *International Journal of Molecular Sciences*, *21*(3), 1157. https://doi.org/10.3390/ijms21031157

Audimoolam, V. K., & Bhandari, S. (2006). Acute interstitial nephritis induced by glucosamine. *Nephrology, Dialysis, Transplantation*, *21*(7), 2031. https://doi.org/10.1093/ndt/gfl025

Barone, G. W., Gurley, B. J., Ketel, B. L., Lightfoot, M. L., & Abul-Ezz, S. R. (2000). Drug interaction between St. John's wort and cyclosporine. *The Annals of Pharmacotherapy*, *34*(9), 1013–1016. https://doi.org/10.1345/aph.10088

Barrett, B. (2003). Medicinal properties of Echinacea: A critical review. *Phytomedicine*, *10*(1), 66–86. https://doi.org/10.1078/094471103321648692

Bauer, S., Störmer, E., Johne, A., Krüger, H., Budde, K., Neumayer, H. H., Roots, I., & Mai, I. (2003). Alterations in cyclosporin A pharmacokinetics and metabolism during treatment with St John's wort in renal transplant patients. *British Journal of Clinical Pharmacology*, *55*(2), 203–211. https://doi.org/10.1046/j.1365-2125.2003.01759.x

Birdee, G. S., Phillips, R. S., & Brown, R. S. (2013). Use of complementary and alternative medicine among patients with end-stage renal disease. *Evidence-Based Complementary and Alternative Medicine*, *2013*, 654109. https://doi.org/10.1155/2013/654109

Blackmer, J., & Jefromova, L. (2002). The use of alternative therapies in the Saskatchewan stroke rehabilitation population. *BMC Complementary and Alternative Medicine*, *2*, 7. https://doi.org/10.1186/1472-6882-2-7

Borrelli, F., & Izzo, A. A. (2009). Herb-drug interactions with St John's wort (Hypericum perforatum): An update on clinical observations. *The AAPS journal*, *11*(4), 710–727. https://doi.org/10.1208/s12248-009-9146-8

Breidenbach, T., Hoffmann, M. W., Becker, T., Schlitt, H., & Klempnauer, J. (2000). Drug interaction of St. John's wort with cyclosporin. *Lancet*, *355*(9218), 1912. https://doi.org/10.1016/s0140-6736(05)73359-6

Brown A. C. (2017). Kidney toxicity related to herbs and dietary supplements: Online table of case reports. Part 3 of 5 series. *Food and Chemical Toxicology*, *107*(Pt A), 502–519. https://doi.org/10.1016/j.fct.2016.07.024

Burrowes, J. D., & Van Houten, G. (2006). Herbs and dietary supplement use in patients with stage 5 chronic kidney disease. *Nephrology Nursing Journal*, *33*(1), 85–88.

Dahl N. V. (2001). Herbs and supplements in dialysis patients: Panacea or poison? *Seminars in Dialysis*, *14*(3), 186–192. https://doi.org/10.1046/j.1525-139x.2001.00051.x

Danao-Camara T. (2000). Potential side effects of treatment with glucosamine and chondroitin. *Arthritis and Rheumatism*, *43*(12), 2853. https://doi.org/10.1002/1529-0131(200012)43:12<2853::aid-anr29>3.0.co;2-r

Duncan M. G. (1999). The effects of nutritional supplements on the treatment of depression, diabetes, and hypercholesterolemia in the renal patient. *Journal of Renal Nutrition*, *9*(2), 58–62. https://doi.org/10.1016/s1051-2276(99)90001-8

Gueye, S., Saint-Cricq, M., Coulibaly, M., Goumri, N., Guilbeau-Frugier, C., Quentin, H., Ged, E., Sidi Aly, A., & Rostaing, L. (2016). Chronic tubulointerstitial nephropathy induced by glucosamine: A case report and literature review. *Clinical Nephrology*, *86*(2), 106–110. https://doi.org/10.5414/cn108781

Guillaume, M. P., & Peretz, A. (2001). Possible association between glucosamine treatment and renal toxicity: Comment on the letter by Danao-Camara. *Arthritis and Rheumatism*, *44*(12), 2943–2944. https://doi.org/10.1002/1529-0131(200112)44:12<2943::aid-art493>3.0.co;2-t

Han, J., Pang, X., Shi, X., Zhang, Y., Peng, Z., & Xing, Y. (2021). Ginkgo biloba extract EGB761 ameliorates the extracellular matrix accumulation and mesenchymal transformation of renal tubules in diabetic kidney disease by inhibiting endoplasmic reticulum stress. *BioMed Research International*, *2021*, 6657206. https://doi.org/10.1155/2021/6657206

Hassen G., Belete G., Carrera K.G., Iriowen R.O., Araya H., Alemu T., Solomon, N., Bam, D. S., Nicola, S. M., Araya, M. E., Debele, T., Zouetr, M., & Jain, N. (2022). Clinical implications of herbal supplements in conventional medical practice: A US perspective. *Cureus*, 14(7), e26893. https://doi.org/10.7759/cureus.26893

Hauser, D., Gayowski, T., & Singh, N. (2002). Bleeding complications precipitated by unrecognized Ginkgo biloba use after liver transplantation. *Transplant International*, *15*(7), 377–379. https://doi.org/10.1007/s00147-002-0432-y

Heller, L. (2008). *Another vegetarian glucosamine launched in US* [webpage]. https://www.nutraingredients-usa.com/Article/2008/01/25/Another-vegetarian-glucosamine-launched-in-US

Huang, J. C., Li, J. H., & Liu, T. X. (2008). Effect of combined therapy with hypha cordyceps and ginkgo leaf tablet on micro-inflammation in patients undergoing maintenance hemodialysis [Abstract]. *Chinese Journal of Integrated Traditional and Western Medicine*, *28*(6), 502–504.

Ji, H., Hu, J., Zhang, G., Song, J., Zhou, X., & Guo, D. (2021). Aristolochic acid nephropathy: A scientometric analysis of literature published from 1971 to 2019. *Medicine*, *100*(27), e26510. https://doi.org/10.1097/MD.0000000000026510

Jialiken, D., Qian, L., Ren, S., Wu, L., Xu, J., & Zou, C. (2021). Combined therapy of hypertensive nephropathy with ginkgo leaf extract and dipyridamole injection and antihypertensive drugs: A systematic review and meta-analysis. *Medicine*, *100*(19), e25852. https://doi.org/10.1097/MD.0000000000025852

Kara B. (2009). Herbal product use in a sample of Turkish patients undergoing haemodialysis. *Journal of Clinical Nursing*, *18*(15), 2197–2205. https://doi.org/10.1111/j.1365-2702.2008.02730.x

Kidney Disease: Improving Global Outcomes (KDIGO) CKD Work Group. (2013). KDIGO 2012 clinical practice guideline for the evaluation and management of chronic kidney disease. *Kidney International Supplement, 3*(1), 1–150. https://kdigo.org/wp-content/uploads/2017/02/KDIGO_2012_CKD_GL.pdf

Kim, S. H., Lee, E. K., Chang, J. W., Min, W. K., Chi, H. S., & Kim, S. B. (2005). Effects of Ginkgo biloba on haemostatic factors and inflammation in chronic peritoneal dialysis patients. *Phytotherapy Research*, *19*(6), 546–548. https://doi.org/10.1002/ptr.1633

Knudsen, J. F., & Sokol, G. H. (2008). Potential glucosamine-warfarin interaction resulting in increased international normalized ratio: Case report and review of the literature and MedWatch database. *Pharmacotherapy*, *28*(4), 540–548. https://doi.org/10.1592/phco.28.4.540

Li, Y. Y., Lu, X. Y., Sun, J. L., Wang, Q. Q., Zhang, Y. D., Zhang, J. B., & Fan, X. H. (2019). Potential hepatic and renal toxicity induced by the biflavonoids from Ginkgo biloba. *Chinese Journal of Natural Medicines*, *17*(9), 672–681. https://doi.org/10.1016/S1875-5364(19)30081-0

Logan, J. L., & Ahmed, J. (2003). Critical hypokalemic renal tubular acidosis due to Sjögren's syndrome: association with the purported immune stimulant echinacea. *Clinical Rheumatology*, *22*(2), 158–159. https://doi.org/10.1007/s10067-002-0671-4

Mai, I., Krüger, H., Budde, K., Johne, A., Brockmöller, J., Neumayer, H. H., & Roots, I. (2000). Hazardous pharmacokinetic interaction of Saint John's wort (Hypericum perforatum) with the immunosuppressant cyclosporin. *International journal of clinical pharmacology and therapeutics*, *38*(10), 500–502. https://doi.org/10.5414/cpp38500

Mai, I., Störmer, E., Bauer, S., Krüger, H., Budde, K., & Roots, I. (2003). Impact of St John's wort treatment on the pharmacokinetics of tacrolimus and mycophenolic acid in renal transplant patients. *Nephrology Dialysis Transplantation*, *18*(4), 819–822. https://doi.org/10.1093/ndt/gfg002

Mandelbaum, A., Pertzborn, F., Martin-Facklam, M., & Wiesel, M. (2000). Unexplained decrease of cyclosporin trough levels in a compliant renal transplant patient. *Nephrology Dialysis Ttransplantation*, *15*(9), 1473–1474. https://doi.org/10.1093/ndt/15.9.1473

Markell M. S. (2005). Potential benefits of complementary medicine modalities in patients with chronic kidney disease. *Advances in Chronic Kidney disease*, *12*(3), 292–299. https://doi.org/10.1016/j.ackd.2005.03.004

Mohammadi, S., Asghari, G., Emami-Naini, A., Mansourian, M., & Badri, S. (2020). Herbal supplement use and herb-drug interactions among patients with kidney disease. *Journal of Research in Pharmacy Practice*, *9*(2), 61–67. https://doi.org/10.4103/jrpp.JRPP_20_30

Mueller, B. A., Scott, M. K., Sowinski, K. M., & Prag, K. A. (2000). Noni juice (Morinda citrifolia): Hidden potential for hyperkalemia? *American Journal of Kidney Diseases*, *35*(2), 310–312. https://doi.org/10.1016/s0272-6386(00)70342-8

Mullins, R. J., & Heddle, R. (2002). Adverse reactions associated with echinacea: the Australian experience. *Annals of allergy, asthma & immunology*, *88*(1), 42–51. https://doi.org/10.1016/S1081-1206(10)63591-0

Murray, M. (2012). Glucosamine. In J.E. Pizzorno & M.T. Murray (Eds.), *Textbook of Natural Medicine* (4th ed., pp. 790–795). Churchill Livingstone.

Naidu, M. U., Shifow, A. A., Kumar, K. V., & Ratnakar, K. S. (2000). Ginkgo biloba extract ameliorates gentamicin-induced nephrotoxicity in rats. *Phytomedicine*, *7*(3), 191–197. https://doi.org/10.1016/s0944-7113(00)80003-3

Natural Medicines. (2022a). *Noni*. https://naturalmedicines.therapeuticresearch.com/databases/food,-herbs-supplements/professional.aspx?productid=758

Natural Medicines. (2022b). *St. John's wort*. https://naturalmedicines.therapeuticresearch.com/databases/food,-herbs-supplements/professional.aspx?productid=329

Natural Medicines. (2022c). *Echinacea*. *Natural Medicines*. https://naturalmedicines.therapeuticresearch.com/databases/food,-herbs-supplements/professional.aspx?productid=981

Natural Medicines. (2022d). *Ginkgo*. https://naturalmedicines.therapeuticresearch.com/databases/food,-herbs-supplements/professional.aspx?productid=333

Natural Medicines. (2022e). *Glucosamine*. https://naturalmedicines.therapeuticresearch.com/databases/food,-herbs-supplements/professional.aspx?productid=807

Nowack, R., Ballé, C., Birnkammer, F., Koch, W., Sessler, R., & Birck, R. (2009). Complementary and alternative medications consumed by renal patients in southern Germany. *Journal of Renal Nutrition*, *19*(3), 211–219. https://doi.org/10.1053/j.jrn.2008.08.008

Osman, N. A., Hassanein, S. M., Leil, M. M., & NasrAllah, M. M. (2015). Complementary and alternative medicine use among patients with chronic kidney disease and kidney transplant recipients. *Journal of Renal Nutrition*, *25*(6), 466–471. https://doi.org/10.1053/j.jrn.2015.04.009

Pavelká, K., Gatterová, J., Olejarová, M., Machacek, S., Giacovelli, G., & Rovati, L. C. (2002). Glucosamine sulfate use and delay of progression of knee osteoarthritis: A 3-year, randomized, placebo-controlled, double-blind study. *Archives of Internal Medicine*, *162*(18), 2113–2123. https://doi.org/10.1001/archinte.162.18.2113

Rashrash, M., Schommer, J. C., & Brown, L. M. (2017). Prevalence and predictors of herbal medicine use among adults in the United States. *Journal of patient experience*, *4*(3), 108–113. https://doi.org/10.1177/2374373517706612

Reginster, J. Y., Deroisy, R., Rovati, L. C., Lee, R. L., Lejeune, E., Bruyère, O., Giacovelli, G., Henrotin, Y., Dacre, J. E., & Gossett, C. (2001). Long-term effects of glucosamine sulphate on osteoarthritis progression: A randomised, placebo-controlled clinical trial. *Lancet*, *357*(9252), 251–256. https://doi.org/10.1016/S0140-6736(00)03610-2

Rozenfeld, V., Crain, J. L., & Callahan, A. K. (2004). Possible augmentation of warfarin effect by glucosamine-chondroitin. *American Journal of Health-System Pharmacy*, *61*(3), 306–307. https://doi.org/10.1093/ajhp/61.3.306

Sherif, I. O., Al-Shaalan, N. H., & Sabry, D. (2019). *Ginkgo biloba* extract alleviates methotrexate-induced renal injury: New impact on PI3K/Akt/mTOR signaling and MALAT1 expression. *Biomolecules*, *9*(11), 691. https://doi.org/10.3390/biom9110691

Shi, S., & Klotz, U. (2012). Drug interactions with herbal medicines. *Clinical Pharmacokinetics*, *51*(2), 77–104. https://doi.org/10.2165/11597910-000000000-00000

Staines, S. (2011). Herbal medicines: Adverse effects and drug-herb interactions. *Journal of the Malta College of Pharmacy Practice*, *17,* 38-42.

Wang, H., Yuan, M., & Zou, X. (2020). Efficacy and safety of Ginkgo biloba for patients with early diabetic nephropathy: A protocol for systematic review and meta-analysis. *Medicine*, *99*(35), e21959. https://doi.org/10.1097/MD.0000000000021959

Wang, J., Qiu, X., Xu, T., Sheng, Z., & Yao, L. (2019). Sclerostin/receptor related protein 4 and ginkgo biloba extract alleviates β-glycerophosphate-induced vascular smooth muscle cell calcification by inhibiting Wnt/β-Catenin Pathway. *Blood Purification*, *47*(Suppl 1), 17–23. https://doi.org/10.1159/000496219

Wangroongsub, Y., Tanavalee, A., Wilairatana, V., & Ngarmukos, S. (2010). Comparable clinical outcomes between glucosamine sulfate-potassium chloride and glucosamine sulfate sodium chloride in patients with mild and moderate knee osteoarthritis: a randomized, double-blind study. *Journal of the Medical Association of Thailand*, *93*(7), 805–811.

Welt, K., Weiss, J., Martin, R., Hermsdorf, T., Drews, S., & Fitzl, G. (2007). Ginkgo biloba extract protects rat kidney from diabetic and hypoxic damage. *Phytomedicine*, *14*(2–3), 196–203. https://doi.org/10.1016/j.phymed.2006.03.023

Yu, X., Su, Q., Geng, J., Liu, H., Liu, Y., Liu, J., Shi, Y., & Zou, Y. (2021). *Ginkgo biloba* leaf extract prevents diabetic nephropathy through the suppression of tissue transglutaminase. *Experimental and Therapeutic Medicine*, *21*(4), 333. https://doi.org/10.3892/etm.2021.9764

Yue, Q.Y., Strandell, J., Myrberg, O. (2006). Concomitant use of glucosamine potentiates the effect of warfarin. *Drug Safety,* 29(10), 911–1010.

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

Evaluating the safety of common herbal supplements in chronic kidney disease, dialysis, and kidney transplant patients

By Nathaniel Lee and Marisa Battistella

1. Which of the following herbal supplements' use could be considered in dialysis patients, although with extreme caution and careful monitoring? (Select all that apply)
   a) St. John's wort
   b) Echinacea
   c) Ginkgo Biloba
   d) Glucosamine

2. Purely from a safety perspective, which of these herbal supplements would you recommend for a patient with stage 4 CKD?
   a) St. John's wort
   b) Echinacea
   c) Ginkgo Biloba
   d) Glucosamine
   e) None of the above

3. A patient with stage 5 CKD who has not started on dialysis yet ingests an excessive amount of echinacea over a one-month period. This patient would expect to encounter what kidney complications? (Select all that apply)
   a) Renal tubular acidosis
   b) Reduced tubular damage
   c) Improved kidney function
   d) Acute kidney failure

4. What risks could a dialysis patient who takes glucosamine and noni juice encounter?
   a) The patient could receive too much potassium through the supplements
   b) The patient could receive too little potassium, as both supplements facilitate potassium excretion
   c) Glucosamine is likely to increase clotting risk
   d) There are no risks to using glucosamine and noni juice

5. Which herbal supplements can increase bleed risks?
   a) St. John's wort
   b) Ginkgo Biloba
   c) Glucosamine
   d) All of the above

6. Which of these below counseling points would one address with a patient who wants to start using St. John's wort? This patient had a successful kidney transplant 14 days ago, is currently on intermittent hemodialysis, and takes tacrolimus.
   a) St. John's wort is possibly effective for depression
   b) St. John's wort use may precipitate an AKI
   c) Tacrolimus will interact with St. John's wort
   d) The patient should be strongly advised to not start St. John's wort
   e) All of the above

7. What could happen in a kidney transplant patient on cyclosporine who starts to take St. John's wort and echinacea for general health benefits? (Select all that apply)
   a) Patient never gets sick again
   b) Acute kidney transplant rejection
   c) Cyclosporine clearance is increased
   d) Cyclosporine clearance is decreased

8. This herbal supplement has many known drug interactions, providing a strong reason to avoid it in CKD, dialysis and kidney transplant patients who are likely to use multiple prescription medications:
   a) St. John's wort
   b) Echinacea
   c) Ginkgo Biloba
   d) Glucosamine

9. What factors should one consider when determining if an herbal supplement is appropriate and safe for a CKD, dialysis or kidney transplant patient?
   a) Specific herbal supplement ingredients and formulation
   b) Current data and literature supporting its efficacy and safety in the specific population
   c) Patient history, medical conditions, and any other patient-specific factors
   d) Herb-drug interactions and herbal supplement adverse effects
   e) All of the above

10. Which tools or resources would one use to find information on an herbal supplement to ensure it is safe for CKD patients to use?
    a) HerbalCKD.com
    b) Natural Medicines
    c) National Kidney Foundation
    d) Pharmacists and Dietitians
    e) All of the above

CONTINUING EDUCATION STUDY ANSWER FORM

CE: 2.0 HRS CONTINUING EDUCATION

Evaluating the safety of common herbal supplements in chronic kidney disease, dialysis, and kidney transplant patients

Volume 32, Number 4

By Nathaniel Lee and Marisa Battistella

Post-test instructions:

- Select the best answer and circle the appropriate letter on the answer grid below.
- Complete the evaluation.
- Send only this answer form (or a photocopy) to:
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POST-TEST ANSWER GRID

Please circle your answer choice:

1.	a	b	c	d	
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4.	a	b	c	d	
5.	a	b	c	d	
6.	a	b	c	d	e
7.	a	b	c	d	
8.	a	b	c	d	
9.	a	b	c	d	e
10.	a	b	c	d	e

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

Comments: _____

_____

_____

_____

COMPLETE THE FOLLOWING:

Name: _____

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CANNT member? ❑ Yes ❑ No Expiration date of card _____

New CANNT Board Members

LISA ROBERTSON, BSCN, RN, CNEPH(C)
VICE-PRESIDENT, ONTARIO 2022–2025

Lisa Robertson is an RN with almost 29 years of renal experience encompassing peritoneal dialysis, nephrology, and renal transplant. She has worked in inpatient, outpatient, and community nursing. She is currently a nurse educator in the renal program at St. Joseph's Healthcare Hamilton (SJHH), covering the inpatient nephrology unit, inpatient renal transplant unit, outpatient PD clinic, outpatient transplant clinic, transplant coordinators, and the Multi-Care Kidney Clinic. Lisa obtained her CNeph(C) in 2004 and has kept it active. Lisa was a co-author for content development of the Peritoneal Dialysis online course offered through Mohawk College. She is a member of the SJHH Kidney Urinary Conference planning committee and was also a member of the 2022 CANNT conference planning committee. She has submitted several posters to CANNT conferences for which she has won a couple of awards and has also done an oral presentation at CANNT. She is certified in GPA, CPI, and BLS, and is also a GPA coach and BLS instructor.

JOAN MACDONALD, MN, BSCN, RN
VICE-PRESIDENT, ATLANTIC 2022–2025

My name is Joan MacDonald (Joni). I am currently a registered nurse in the rural town of Sydney on Cape Breton Island in Nova Scotia. I graduated with my BScN in 2017 from Cape Breton University, and more recently in 2022, I graduated with my Master of Nursing through Athabasca University. I work in the Renal Department (Hemodialysis) in our regional hospital, which houses five satellite units within our 'zone' for the past six years. I am an avid researcher in areas such as marginalized groups in rural communities on hemodialysis, vascular dysfunction, CVC infections, and new nurse training. I believe in my region there is little known about CANNT, and I hope to advocate for new members, increasing education and research within the renal population to advance patient care.

RACHAEL BLAIR, MED, BSCN, RN, CNEPH(C)
DIRECTOR OF COMMUNICATIONS 2022–2024

My name is Rachael Blair. I have been a nurse for almost 20 years and have spent 17 years in nephrology. I graduated from Dalhousie University in 2003 with a Bachelor of Science in Nursing. In May 2022, I completed a Masters of Adult Education and Health from Saint Francis Xavier University. I have held several positions within the Nova Scotia Renal and Transplant program such as charge nurse, resource nurse, clinical leader of operations for the satellite and home dialysis program, nurse educator, and, at present, a transplant recipient coordinator. I am a mom of two beautiful boys, and I have a wonderful husband. I enjoy spending quality time with family and exploring the outdoors. Throughout my career, I have always strived to improve the lives of our renal patients through education, initiatives, and quality improvement. I believe CANNT provides the resources and network to connect with others who strive to achieve the same. In taking on the role of Director of Communications for CANNT, my hope is to assist in broadening our network and community through connecting with others throughout our organization and beyond. I am looking forward to this role and discovering what we can achieve together!

Meet the 2022 CANNT Bursary, Award, and Research Grant Winners

FRANCA TANTALO BURSARY AWARD SPONSORED BY FRESENIUS MEDICAL CARE

JUDY UKRAINETZ, BN, RN, CNEPH(C) – ALBERTA

Judy Ukrainetz is currently involved in research for the division of nephrology, and her interest lies in fluid volume regulation for hemodialysis patients. She is also a clinical registered nurse working for Alberta Health Services at the University of Alberta Hospital, with a focus on hemodialysis treatment and patient education. In addition, she is a Master of Nursing candidate at Athabasca University with a teaching focus. She has a very strong interest in educating not only hemodialysis patients about sodium, fluid intake, and hypertension, but also educating staff and improving the quality of care delivered to the dialysis population. She is passionate about motivating others and about being a leader who influences change in order to bring about individual health reform. She is most looking forward to applying her master's education towards collaborating with others who love nephrology as much as she does.

NURSING RESEARCH GRANT SPONSORED BY AMGEN

ELKE JAIBEEH BARAH, BNS, PGCERT, RN, CNEPH(C), MN (STUDENT) – ALBERTA

Elke Jaibeeh Barah is a nurse case manager at the home hemodialysis unit at the Sheldon M. Chumir Health Centre in Calgary. She is an up-and-coming nurse researcher who is working to improve home modality education for patients. Her current project focuses on understanding hemodialysis nurses' practices on modality education in renal replacement therapies to propose practices that may improve home dialysis uptake and patient outcomes. Elke works collaboratively with nephrologists, dietitians, pharmacists, social workers, and her patients who take an active role in their kidney disease management.

Elke received her Bachelor of Nursing Science from the University of Buea-Cameroon, Graduate Certificate in Health Sciences from the University of Warwick - United Kingdom, and she is currently in her first year of the Master of Nursing Program at the University of Calgary. Elke also holds the Canadian Nurses Association's nephrology certification. Elke has 13 years of experience in nephrology nursing, working in in-centre hemodialysis, home hemodialysis, and dialysis transitions. Elke has held leadership roles in developing curricula for the training of home dialysis patients and for increasing the uptake of home dialysis modalities including home hemodialysis and peritoneal dialysis. Elke continues to seek ways to enhance renal patient outcomes and system outcomes.

CANNT RESEARCH AWARD
SPONSORED BY NIPRO
KOKAB YOUNIS, BN, RN, MN(STUDENT) - ALBERTA

Kokab Younis a dedicated registered nurse in the Alberta Kidney Care - South Program, where she provides direct patient care to the hemodialysis population. She is an active member of the Quality Improvement team. She is actively involved in a quality improvement initiative focusing on standardizing the approach to vascular access malfunction and enhancing clinical practice.

Kokab received a Bachelor of Nursing from Mount Royal University in 2015. She has taken the Advanced Critical Care and Emergency Nursing certificate to further advance her knowledge and assessment skills in managing critical patients. Kokab is currently completing a Master of Nursing graduate degree program at the University of Calgary. Her research interests include the mental health needs of the dialysis population, quality improvement, patient-oriented research, diabetes, and end-stage renal disease.

2022 CANNT JOURNAL AWARD
SUPPORTED BY CANNT

A standardized approach for the post-operative management of hypocalcemia in dialysis patients with secondary hyperparathyroidism requiring parathyroidectomy

(*CANNT Journal*, 2022, *31*[4], 11-20)
Jaclyn Tran, BSc Pharm, ACPR
Maria Harlow-Gillighan, BSc Neuroscience, BSc Pharm
Benjamin Taylor, MD, FRCSC
Marsha Wood, MN
Carolyn Bartol, BScN, RN, CNeph(C)
Steven Soroka, BMus, MD, MSc, FRCPC
Kenneth West, MD, FRCPC
Jo-Anne S. Wilson, BSc Pharm, ACPR, PharmD
(Halifax, Nova Scotia)

JACLYN TRAN, BSC PHARM, ACPR

Jaclyn grew up in Kitimat, a small town in Northern British Columbia. After high school, she studied at the University of Alberta, where she completed a Bachelor of Science in Pharmacy in 2011. She then completed a hospital pharmacy residency in Northern BC before moving to Halifax in 2012. Like most new pharmacists in the hospital setting, she trained in several areas at the Queen Elizabeth Health Sciences Centre, including inpatient and outpatient pharmacy dispensaries, chemotherapy preparation, general surgery, and medicine. She has now been working in nephrology since 2015. Her particular interests include optimizing medication management (especially through deprescribing) to improve their quality of life, supporting other healthcare professionals in patient care through collaboration or education, and most of all reviewing current practice for quality improvement. Working on improving post-operative calcium management post-parathyroidectomy in dialysis patients, with stakeholders from nephrology and otolaryngology, has been a highlight in Jaclyn's career. Dialysis nurses originally identified the need for quality improvement post-parathyroidectomy and have been instrumental in the development and implementation of this project. Outside of work, Jaclyn can be found spending time with her family, walking her dogs, and playing recreational fastball.

CALL FOR ABSTRACTS

CANNT-ACITN invites you to join us in Charlottetown October 26–28, 2023!

Abstracts are currently being accepted for ORAL and POSTER presentations for CANNT-ACITN 2023 – **"CANNT stop, won't stop – Finding creative ways to bridge the gap"**. Abstract submissions should incorporate the theme—sharing our knowledge and experience—appropriate for the novice through to the advanced practice professional.

Topics of interest may include: clinical research, innovative projects and solutions, ethics, case presentations and clinical reviews. All abstract submissions must be evidence-based.

ABSTRACT SUBMISSION GUIDELINES:

Deadline: March 1, 2023
All abstracts must be submitted online (**www.cannt-acitn.ca**) through the online submission form.

Submissions must include the following:

1. Abstract Title
   - must accurately reflect the content of the presentation
   - must be formatted in sentence case (capitalize first word and remaining words begin in lower case)
2. Authors and Affiliations
   - must be included under the title and formatted as follows: Anne L. Smith[a], RN, CNeph(C), Robert G. Jones[a,b], RN

   [a]Department of Nephrology, University of Toronto, Toronto, ON; [b]Department of Nephrology, University of Alberta Hospital, Edmonton, AB.

   Underline the name and initials of the presenter(s).
3. Abstract Text
   - should be no longer than 300 words including headings (do not include pictures, tables or references)
   - should be as informative as possible
   - define all abbreviations the first time they appear in the abstract
   - use only the generic names of drugs
   - do not identify companies and/or products in the body or title of the abstract

   If research-based, must include below headings:
   - background
   - purpose of study
   - methods
   - results
   - conclusions
   - implications for nephrology care

   If practice/education/narrative-based, must include below headings:
   - background
   - purpose of the project
   - description
   - evaluation/outcome
   - implications for nephrology practice/education

LEADING EDGE TOPICS INCLUDE:

- Transplant
- Mental Health and CKD
- Cardiovascular Disease and CKD
- Future Directions of CKD and Treatment
- Pregnancy with Renal Disease
- Pediatrics
- Ethics and Elderly Care
- Medical Assistance in Dying
- Technical Advances in Dialysis Equipment
- Home Therapies

IMPORTANT NOTES:

Only COMPLETE submissions received by March 1, 2023 will be considered.

- All correspondence will be with the first author only.
- Acceptance of abstract does not waive attendance fees (registration).
- Notification regarding selection decisions will be provided by **May 15.**
- Should the abstract be selected for presentation, the author(s) authorize(s) the publication of the abstract submitted for publication in the CANNT-ACITN Journal.
- The presentation shall not make comparison to companies or products for any purposes of product marketing, nor will topics or materials used discredit companies or products.
- The abstract, and associated authors, should make full disclosure of corporate employment and/or funding sources.
- Abstracts not in the required format will be returned to the author for revision.
- The language of abstract submission will be the language of presentation, if selected.

SUBMIT ABSTRACTS TO:

Online: **www.cannt-acitn.ca**

QUESTIONS:

Email: **cannt@cannt.ca**

CANNT Journal Manuscript Submission Guidelines

DESCRIPTION

CANNT Journal is a quarterly publication that showcases excellence in nephrology nursing and technological writing through peer-reviewed articles that examine current issues and trends in nephrology nursing and technological practice, education, and research. *CANNT Journal* is the official journal of the Canadian Association of Nephrology Nurses and Technologists and supports the association's mission to serve its membership by advancing the development of nephrology nursing and technological knowledge. The journal is indexed in MEDLINE and CINAHL.

EDITORIAL POLICIES

CANNT Journal welcomes manuscripts related to nephrology nursing and technological education, practice, research, or health policy. The manuscript must be the sole intellectual property of the authors. Once accepted, manuscripts become the permanent property of *CANNT Journal*, and may not be reproduced elsewhere without written permission from the publisher.

We prefer manuscripts that present new clinical information or address issues of special interest to nephrology nurses and technologists. In particular, we are looking for:

- Original research reports
- Relevant clinical articles
- Innovative quality improvement reports
- Narratives that describe the nursing experience
- Interdisciplinary practice questions and answers
- Literature or systematic reviews

We also encourage letters to the editor as a way to promote dialogue and alternative perspectives to articles published in *CANNT Journal*. Choose "Letters to the Editor" from the Section dropdown on the submissions page.

SUBMISSION DECLARATION

Submission of the article implies that the work described has not been published elsewhere (except in the form of an abstract or a published lecture), that it is not under consideration for publication elsewhere, that its publication is approved by all authors and responsible authorities where the research was carried out, and that, if accepted, it will not be published elsewhere in the same form without the written consent of the copyright holder. Upon acceptance of the submitted material, the author(s) must transfer copyright ownership to *CANNT Journal*. Statements and opinions contained within the work will remain the responsibility of the author(s).

PEER REVIEW

CANNT Journal operates on a double-blind peer review process. The names of the reviewers will not be disclosed to the author(s) submitting the manuscript, and the name(s) of the author(s) will not be disclosed to the reviewers.

All contributions will be initially assessed by the editors for suitability for the journal. Manuscripts deemed suitable are sent to two independent expert reviewers to assess the quality of the paper. A manuscript will only be sent for review if the editors determine that the paper meets the appropriate quality and relevance requirements in keeping with the particular aim and scope of *CANNT Journal*.

The editors are responsible for the final decision regarding acceptance or rejection of the manuscript. Editors are not involved in decisions about papers that they have written themselves or have been written by family members or colleagues, or which relate to products or services in which the editor has an interest. All manuscript submissions are subject to the journal's usual independent peer review process.

The criteria for acceptance for all manuscripts include the quality and originality of the research or intellectual material, its significance/appeal to journal readership, and the general writing style.

PREPARING THE SUBMISSION

The following components are required for all submissions. Manuscripts that do not meet these requirements will be returned to the corresponding author for technical revisions before undergoing peer review.

The manuscript should be submitted in separate files in the following order: title page; abstract with key words; main text including references; and figures/tables. A cover letter may be supplied at the authors' discretion.

Title page

Include:

- Title of the manuscript (concise and informative)
- Short running title of fewer than 40 characters
- Full names, highest academic degrees, and affiliations of all authors with email address and telephone/fax number of corresponding author
- Authors' institutional affiliations (department, institution, city, country) where research work was conducted
- Any acknowledgements (including disclosure of funding), credits, or disclaimers, conflict of interest statement for all authors

Abstract and keywords

Submit structured or summary abstract of up to 250 words. Word limit includes headers in a structured abstract (e.g., *background*, *purpose*, *method*, *findings*, and *discussion*).

The abstract should be a succinct summary of the major issue, problem, or topic being addressed, and the findings and/or conclusions in the manuscript. It should not duplicate material in the main text. It should not contain subheadings, abbreviations, or reference citations.

Provide up to eight keywords that describe the contents of the manuscript.

Main text (manuscript, reference list)

Main text:

- Maximum length 15–20 pages, double-spaced
- Use the *Publication Manual of the American Psychological Association* (APA) 7th edition (copyright 2020) for style and format guidelines.
- As manuscripts are double-blind peer reviewed, the main text should not include any information that might identify the authors. Therefore, do not include any identifying information (i.e., authors' names).
- Number all pages consecutively in the upper right-hand corner.
- Cite tables/figures consecutively.
- Be sure to approve or remove all tracking changes in your Word document before uploading.

References:

- Use only sources from credible and high-quality journals.
- Double-spaced at the end of the manuscript
- Citations and reference list is to be styled according to the APA 7th edition (copyright 2020).
- Provide URL for all references where available.
- Ensure that every reference cited in the text is also present in the reference list (and vice versa).

Tables/figures

- Submit each table or figure as a separate file, and as editable text and not as an image.
- Prepare tables/figures according to APA 7th edition (copyright 2020).
- Cite tables/figures consecutively in the text, and number them in that order. Do not embed tables/figures in the manuscript text file.
- Number table and figure consecutively in accordance with their appearance in the text and place the title of the table/figure and any table/figure notes below the table/figure body.
- Use tables sparingly and ensure that the data presented in them clarify and supplement, rather than duplicate, results described in the main text. Only tables that are 3 manuscript pages or shorter will be accepted to be published within the article.
- Authors using previously published tables and figures must include written permission from the original publisher. Such permission must be attached to the submitted manuscript.

MANUSCRIPT SUBMISSION

Once the submission materials have been prepared in accordance with instructions in "Preparing the Submission" above, manuscripts must be submitted online at: **https://cannt-acitn.ca/journal/ojs/index.php/canntj**

New users must click "Register" at the upper right of the page. Once logged in, select "Submissions" from the "About" dropdown.

AFTER SUBMISSION

There are three stages of manuscript review prior to the final decision about the article's status for publication.

Preliminary

Preliminary review by the editors to determine the suitability of the article for peer review. The editors assess all manuscript presentation requirements including style and format of the manuscript.

Editorial peer review

The peer review process determines scholarly merit of the article. All manuscripts are reviewed by two members of the Editorial Review Panel. The acceptance criteria for all papers lie in the quality and originality of the work and its significance to journal readership. Manuscripts are only sent to reviewers if the editors determine that the paper merits further review.

Determination of eligibility for publication

After the peer review, the editors make a decision regarding the eligibility of the article for selection based on the comments and recommendations of the reviewers. Based on the peer review evaluation, the editors make one of the following decisions:

- Accept without revisions
- Accept after completing minor revisions
- Re-submit after completing major revisions – re-review by original reviewers
- Reject

AFTER ACCEPTANCE

Corresponding authors will receive a PDF proof of the article. The page proof should be carefully proofread for any copyediting or typesetting errors. It is the authors' responsibility to ensure that there are no errors in the proofs. Authors should also make sure that any renumbered tables, figures, or references match text citations and that figure legends correspond with text citations and actual figures. Proofs must be returned within the deadline specified by the editors.

Alterations to the proof that are beyond those required to correct errors or to answer queries, or are a reworking of previously accepted material will **not** be allowed. The editors reserve the right to deny any changes that do not affect the accuracy of the content.

POST PUBLICATION

The corresponding author will receive a hard copy of the journal issue as well as a PDF copy of the article.

If accepted, your article must not be published elsewhere in similar form, in any language, without the consent of the publisher. You may not post the PDF file of your copyedited article, or your final published article in any repository or online social media site.

OPEN ACCESS OPTION

Authors of accepted peer-reviewed articles have the choice to pay a fee to allow perpetual unrestricted online access to their published article to readers globally, immediately upon publication. This option has no influence on the peer review process. All manuscripts are subject to *CANNT Journal*'s standard double-blinded peer-review process and will be accepted or rejected based on their own merit.

The article processing charge of $250.00 is charged on acceptance of the manuscript and should be paid within 5 days by the author(s). Payment must be processed for the article to be published open access.

CONFLICTS OF INTEREST AND SOURCE OF FUNDING

At the time of manuscript submission, authors should disclose any potential sources of conflict of interest, which includes any financial interest or relationship that might be perceived as influencing the authors' objectivity. The existence of a conflict of interest does not preclude publication. Authors must also declare if they have no conflict of interest to declare. Sources of funding should be included on the title page under the heading "Conflicts of Interest and Source of Funding." Each author must complete and submit the journal's copyright transfer agreement, which includes a section on the disclosure of potential conflicts of interest.

COPYRIGHT TRANSFER AGREEMENT

At the time of submission, the submitting author will be presented with the copyright transfer and conflict of interest form. Co-authors will receive an email with instructions to also complete the form in order to proceed with the review process.

EDITORIAL OFFICE CONTACT DETAILS

Jovina Bachynski and Rosa Marticorena, Editors
cannt.journal1@gmail.com

SUBMIT YOUR MANUSCRIPT ONLINE TODAY

https://cannt-acitn.ca/journal/ojs/index.php/canntj

Lignes directrices pour la soumission des manuscrits au *Journal ACITN*

DESCRIPTION

Le *Journal ACITN* est une revue publiée trimestriellement qui met en valeur l'excellence des écrits sur les soins infirmiers et les technologies en néphrologie par le biais d'articles évalués par des pairs qui examinent les questions et les tendances actuelles de la pratique, de la formation et de la recherche dans ce domaine. Le *Journal ACITN* est la revue officielle de l'Association canadienne des infirmières et infirmiers et des technologues de néphrologie et soutient la mission de l'association pour servir ses membres en perfectionnant le développement des connaissances en matière de soins infirmiers et de technologies en néphrologie. La revue est référencée dans les bases de données MEDLINE et CINAHL.

POLITIQUES RÉDACTIONNELLES

Le *Journal ACITN* accepte les manuscrits portant sur la formation, la pratique, la recherche sur les soins infirmiers et les technologies de néphrologie ou la politique en matière de santé. Le manuscrit doit être la propriété intellectuelle unique des auteurs. Une fois acceptés, les manuscrits deviennent la propriété permanente du *Journal ACITN* et ne peuvent être reproduits ailleurs sans l'autorisation écrite de l'éditeur.

Nous préférons les manuscrits qui présentent de l'information clinique nouvelle ou qui abordent des problématiques d'intérêt particulier pour les infirmières et infirmiers et les technologues en néphrologie. Plus précisément, nous recherchons :

- Rapports de recherche originaux;
- Articles cliniques pertinents;
- Rapports sur des approches innovatrices en matière d'amélioration de la qualité;
- Textes narratifs relatant une expérience de pratique infirmière ou technologique;
- Textes sous forme de questions et de réponses sur la pratique interdisciplinaire;
- Revues de littérature ou revues systématiques.

Nous encourageons également les tribunes libres sous forme de courrier des lecteurs comme moyen de promouvoir le dialogue et des perspectives de rechange aux articles publiés dans le *Journal ACITN*. Veuillez choisir « Courrier des lecteurs » dans le menu déroulant de la Section sur la page des soumissions.

DÉCLARATION RELATIVE À LA SOUMISSION

La soumission de l'article laisse entendre que l'œuvre décrite n'a pas été diffusée autre part (sauf sous la forme d'un résumé ou d'une présentation orale publiée), qu'elle n'est pas à l'étude pour publication ailleurs, que sa publication est approuvée par tous les auteurs et les autorités responsables où la recherche a été réalisée, et que, si elle est acceptée, elle ne sera pas publiée ailleurs sous la même forme sans le consentement écrit du titulaire du droit d'auteur. À l'acceptation du document soumis, le ou les auteurs devront transférer la propriété du droit d'auteur au *Journal ACITN*. Les déclarations et les opinions contenues dans l'œuvre demeurent la responsabilité de l'auteur ou des auteurs.

ÉVALUATION PAR LES PAIRS

Le *Journal ACITN* fonctionne selon un processus d'évaluation par les pairs à double insu. Les noms des évaluateurs ne seront pas divulgués à l'auteur ou aux auteurs qui auront soumis le manuscrit, de même que le ou les noms des auteurs ne seront pas divulgués aux évaluateurs.

Toutes les contributions seront initialement évaluées par les rédactrices en chef pour leur pertinence à la revue. Les manuscrits réputés acceptables sont envoyés à deux experts indépendants qui en évalueront la qualité. Un manuscrit ne sera envoyé pour évaluation que si les rédactrices en chef déterminent que le manuscrit répond aux exigences de qualité et de pertinence appropriées, conformément à l'objectif et au champ d'application particuliers du *Journal ACITN*.

Les rédactrices sont responsables de la décision définitive en ce qui a trait à l'acceptation ou au rejet du manuscrit. Les rédactrices en chef n'interviennent pas dans les décisions relatives aux articles qu'elles-mêmes ont rédigés ou que des proches ou des collègues ont écrits ou encore qui portent sur des produits ou services pour lesquels elles sont en conflit d'intérêts. Toutes les soumissions de manuscrit font l'objet du processus habituel d'évaluation par les pairs indépendants de la revue.

Les critères d'acceptation de tous les manuscrits comprennent la qualité et l'originalité de la recherche ou du matériel intellectuel, son importance ou son attrait pour le lectorat de la revue et le style d'écriture en général.

PRÉPARATION DE LA SOUMISSION

Les éléments suivants sont requis pour toutes les soumissions. Les manuscrits qui ne répondent pas à ces exigences seront renvoyés à l'auteur-ressource en vue de révisions techniques avant d'être soumis à l'évaluation par les pairs.

Le manuscrit doit être soumis en fichiers séparés dans cet ordre : page titre; résumé avec mots clés; corps du texte incluant les références; et les figures ou les tableaux. Une lettre de présentation peut être fournie à la discrétion des auteurs.

Page titre

Inclure :

- Titre du manuscrit (concis et descriptif)
- Titre court comptant moins de 40 caractères
- Nom complet, diplôme de plus haut grade et affiliations de tous les auteurs, adresse courriel et numéros de téléphone/télécopieur de l'auteur-ressource
- Affiliations institutionnelles des auteurs (département, établissement, ville, pays) où les travaux de recherche ont été réalisés
- Tous les remerciements (y compris la divulgation du financement), les crédits ou les avertissements, un énoncé de conflit d'intérêts pour tous les auteurs

Résumé avec mots clés

Soumettre un résumé structuré ou succinct de 250 mots au maximum. La limite de mots inclut les en-têtes dans un résumé structuré (p. ex., *contexte*, *objet*, *méthode*, *résultats* et *discussion*).

Le résumé doit être une description succincte de la question, du problème ou du sujet principal abordé dans le manuscrit, ainsi que les résultats ou conclusions présentés. Il ne doit pas reproduire le corps du texte. Il ne doit pas contenir de sous-titres, d'abréviations ou de citations de référence.

Fournir jusqu'à huit mots clés qui décrivent le contenu du manuscrit.

Corps du texte (manuscrit, liste de référence)

Corps du texte :

- Longueur maximum de 15 à 20 pages, à double interligne
- Se servir du guide de style *Publication Manual of the American Psychological Association* (APA), 7e édition (droit d'auteur 2020) pour les lignes directrices en matière de style et de format
- Comme les manuscrits font l'objet d'une évaluation par des pairs à double insu, le corps du texte ne doit inclure aucune information pouvant servir à identifier les auteurs. Par conséquent, il ne faut pas inclure de renseignements d'identification (p. ex., noms des auteurs)
- Paginer sans interruption dans le coin supérieur droit
- Citer les tableaux ou les figures à la suite
- S'assurer d'approuver ou d'éliminer toutes les modifications de suivi de votre document Word avant le téléversement

Références :

- N'utiliser que des sources publiées dignes de foi et de qualité
- À double interligne à la fin du manuscrit
- La liste de citations et de références doit être conforme au guide de style de l'APA, 7e édition (droit d'auteur 2020)
- Fournir les adresses URL pour toutes les références, le cas échéant
- S'assurer que toutes les références citées dans le texte figurent dans la liste de référence (et vice versa)

Tableaux ou figures

- Soumettre chaque tableau ou figure dans un fichier séparé, sous forme modifiable et non sous forme d'image
- Préparer les tableaux ou les figures selon le guide de style de l'APA, 7e édition (droit d'auteur 2020)
- Citer les tableaux ou les figures à la suite dans le texte et les numéroter dans cet ordre. Ne pas incorporer les tableaux ou les figures dans le fichier texte du manuscrit
- Numéroter les tableaux et les figures à la suite selon leur apparition dans le texte et positionner le titre du tableau ou de la figure et toute note connexe sous le corps du tableau ou de la figure
- Utiliser les tableaux avec retenue et s'assurer que les données qui y sont présentées clarifient et complètent les résultats décrits dans le corps du texte, sans toutefois les reproduire. Seuls les tableaux sur 3 pages de manuscrit ou moins seront acceptés aux fins de publication dans l'article.
- Les auteurs qui utilisent des tableaux ou des figures précédemment publiés doivent inclure l'autorisation écrite de l'éditeur original. Cette autorisation doit être jointe au manuscrit soumis.

SOUMISSION DU MANUSCRIT

Après avoir préparé le matériel de soumission conformément aux directives indiquées dans la rubrique « Préparation de la soumission » ci-dessus, les manuscrits doivent être soumis en ligne à cette adresse : **https://cannt-acitn.ca/journal/ojs/index.php/canntj**

Les nouveaux utilisateurs doivent cliquer sur « Register » (S'inscrire) dans le coin supérieur droit de la page. Une fois inscrit, sélectionner « Submissions » (Soumissions) du menu déroulant « About » (À propos de).

APRÈS LA SOUMISSION

L'examen du manuscrit se déroule en trois étapes avant que la décision ultime soit prise sur le statut de l'article aux fins de publication.

Examen préliminaire

Examen préliminaire par les rédactrices en chef afin de déterminer la pertinence de l'article aux fins d'évaluation par les pairs. Les rédactrices en chef examinent toutes les exigences de présentation de manuscrits, notamment le style et le format du manuscrit.

Évaluation rédactionnelle par les pairs

Le processus d'évaluation par les pairs détermine la valeur scientifique de l'article. Tous les manuscrits sont évalués par deux membres du comité d'évaluation rédactionnelle. Les critères d'acceptation pour tous les textes reposent sur la qualité et l'originalité de l'œuvre et sur son importance aux yeux du lectorat de la revue. Les manuscrits sont envoyés aux évaluateurs uniquement si les rédactrices en chef décident que le texte mérite un examen plus approfondi.

Détermination de l'admissibilité aux fins de publication

Après l'évaluation par les pairs, les rédactrices en chef prennent une décision concernant l'admissibilité de l'article à la sélection en se fondant sur les commentaires et les recommandations des évaluateurs. Selon l'évaluation par les pairs, les rédactrices en chef prennent l'une des décisions suivantes :

- Accepter le manuscrit sans modifications
- Accepter le manuscrit une fois les modifications mineures apportées
- Soumettre de nouveau le manuscrit une fois les modifications majeures apportées – réévaluation par les évaluateurs d'origine
- Rejeter le manuscrit

APRÈS L'ACCEPTATION

Les auteurs-ressources recevront une épreuve en format PDF de l'article. L'épreuve d'imposition doit être soigneusement relue afin de détecter toute erreur d'édition ou de composition. Il incombe aux auteurs de s'assurer que les épreuves sont exemptes d'erreurs. Les auteurs doivent également s'assurer que les tableaux, les figures ou les références renumérotés correspondent aux citations du texte et que les légendes des figures correspondent aux citations du texte et aux figures réelles. Les épreuves doivent être renvoyées dans le délai précisé par les rédactrices en chef.

Les modifications apportées à l'épreuve qui vont au-delà de ce qui est nécessaire pour corriger des erreurs ou pour répondre à des questions ou qui constituent un remaniement du matériel précédemment accepté **ne** seront **pas** permises. Les rédactrices en chef se réservent le droit de rejeter toute modification qui n'influe pas sur l'exactitude du contenu.

APRÈS LA PUBLICATION

L'auteur-ressource recevra une copie papier du numéro de la revue ainsi qu'une copie PDF de l'article.

S'il est accepté, votre article ne doit pas être publié nulle part ailleurs sous une forme similaire, en toute autre langue, sans le consentement de l'éditeur. Vous ne pouvez pas publier le fichier PDF de votre article révisé ou de votre article définitif publié dans un service d'archives ou sur un site de médias sociaux en ligne.

OPTION D'ACCÈS LIBRE

Les auteurs d'articles acceptés dans le cadre d'une évaluation par les pairs peuvent choisir de payer une redevance pour permettre aux lecteurs du monde entier d'accéder en ligne à leur article publié, sans restriction et à perpétuité, dès sa publication. Cette option n'a aucune influence sur le processus d'évaluation par les pairs. Tous les manuscrits font l'objet d'un processus standard d'évaluation par les pairs à double insu et seront acceptés ou refusés en fonction de leur propre valeur.

Des frais de traitement de l'article de 250,00 $ sont facturés à l'acceptation du manuscrit et doivent être payés dans les cinq (5) jours par le ou les auteurs. Le paiement doit être traité pour que l'article soit publié en accès libre.

CONFLITS D'INTÉRÊTS ET SOURCE DE FINANCEMENT

Au moment de la soumission du manuscrit, les auteurs doivent divulguer toute source potentielle de conflit d'intérêts, ce qui inclut toute relation ou tout intérêt financier qui pourrait être perçu comme influençant leur objectivité. La présence d'un conflit d'intérêts n'empêche pas la publication. Les auteurs doivent également déclarer qu'ils n'ont aucun conflit d'intérêts à déclarer. Les sources de financement doivent figurer sur la page titre sous la rubrique « Conflits d'intérêts et source de financement ». Chaque auteur doit remplir et soumettre le formulaire d'entente de transfert du droit d'auteur de la revue, lequel comprend une section sur la déclaration de conflits d'intérêts potentiels.

ENTENTE DE TRANSFERT DU DROIT D'AUTEUR

Au moment de la soumission, l'auteur qui soumet un manuscrit recevra un formulaire d'entente de transfert du droit d'auteur et de déclaration de conflits d'intérêts. Les coauteurs recevront des directives par courriel pour aussi remplir le formulaire afin d'amorcer le processus d'évaluation.

COORDONNÉES DU BUREAU DE LA RÉDACTION

Jovina Bachynski et Rosa Marticorena, rédactrices
cannt.journal1@gmail.com