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L'ASSOCIATION CANADIENNE DES INFIRMIÈRES ET TECHNICIENS DE NÉPHROLOGIE

CONTENTS

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Pursuing Your Inner Power

Janet Baker

Alison Thomas

Pursuing the Power Within! This is the theme for CANNT 2014—our annual conference taking place from October 23–25 in Niagara Falls, Ontario. What does pursuing your inner power mean to you? How does it relate to your daily work activities? Are you able to rely on your inner power when you need it most? If you have had an abstract for a poster or oral presentation accepted, and are interested in publishing, you are encouraged to submit your manuscript early, and you will qualify for the CANNT Manuscript Award. You will be receiving more information about this opportunity directly from the CANNT National office.

In this issue, the publications highlight two very key issues in CKD patient management—quality improvement and anemia management. Our lead article, by Harwood, Wazny, and Wilson, summarizes the updated KDIGO guideline for anemia management and compares them to the CSN commentary. We hope that these articles will resonate as you consider their relationship to your own units and day to day practice.

Finally, Nephrology Healthcare Professionals Day is September 17, 2014. We encourage you to take this day to recognize your interdisciplinary healthcare team and acknowledge the impact that your collaboration has on patient care and the patient experience. If you have a formal celebration, consider sending us some pictures to add to the next issue of the Journal.

Enjoy the remainder of the summer—and we look forward to seeing you at CANNT 2014 in scenic Niagara Falls!

Janet Baker & Alison Thomas

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« Pursuing Your Inner Power » (Miser sur sa force intérieure)

Janet Baker

Alison Thomas

Miser sur sa force intérieure! Voici le thème du symposium annuel de l'ACITN qui aura lieu du 23 au 25 octobre, à Niagara Falls, en Ontario. Que signifie pour vous miser sur sa force intérieure? De quelle manière ce thème touche-t-il vos activités professionnelles quotidiennes? Pouvez-vous compter sur votre force intérieure en cas de nécessité? Si l'une de vos communications pour une affiche ou une présentation orale a été acceptée et que l'idée de la publier vous intéresse, nous vous invitons à soumettre dès maintenant votre manuscrit afin d'être admissible au prix de l'ACITN. Vous recevrez plus de détails concernant ce prix directement du bureau national de l'ACITN.

Dans ce numéro, les articles soulignent deux éléments très importants de la prise en charge du patient atteint de néphropathie chronique—l'amélioration de la qualité de vie et la prise en charge de l'anémie. Notre article principal, rédigé par Harwood, Wazny et Wilson, résume les lignes directrices à jour de KDIGO pour la prise en charge de l'anémie et les compare aux observations de la Société canadienne de néphrologie (SCN). Nous espérons que ces articles trouveront écho dans l'examen de vos propres services et de votre pratique quotidienne.

Finalement, la Journée des professionnels de la santé en néphrologie aura lieu le 17 septembre 2014. Nous vous incitons à profiter de cette journée pour souligner l'impact que votre collaboration avec l'équipe de soins interdisciplinaire a sur les soins aux patients et leur expérience. Si vous organisez une fête officielle, pensez à nous envoyer des photos que nous pourrons ajouter au prochain numéro.

Profitez de la fin de l'été—et nous vous attendons au symposium de l'ACITN de 2014 dans la belle ville de Niagara Falls!

Janet Baker et Alison Thomas

PLEASE SEND ALL SUBMISSIONS, QUESTIONS OR COMMENTS TO:

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Voici les échéanciers à rencontrer pour soumettre des articles/nouvelles au journal :

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Celebrate Your Achievements

Benjamin Franklin once said: "An investment in knowledge pays the best interest."

Congratulations to the 235 nurses nation-wide who have invested in their knowledge and attained CNA certification or recertification in nephrology nursing this spring. Your hard work and dedication to your specialty are commendable. Nephrology nursing is one of only twenty specialties that offer certification through the Canadian Nurses Association. In support of CNA certification, a certification preparation workshop is being offered on Thursday, October 23, as part of CANNT 2014 in Niagara Falls, Ontario. This workshop is beneficial for anyone who is considering writing the certification exam.

The Canadian Nurses Association is the national professional voice of registered nurses in Canada. It supports best practice and promotes the nursing profession. As an Association, it also lobbies government to enact health policy that is in the best interest of all Canadians. As CANNT representative, I had the privilege of attending the CNA Biennial Convention held in Winnipeg, MB from June 16 to 18, 2014. This was a very different and motivating learning experience for me, as it focused on health policy rather than clinical practice. During the Annual General Meeting, resolutions were passed in order for CNA to comply with Canada's Not-For-Profit Act. Many other resolutions were brought forward and debated enthusiastically prior to being passed, thus requiring CNA to lobby government to act. Two resolutions were passed that I feel, if government lobbying is successful, will greatly impact the renal population. They are: improving health equity for Aboriginal peoples, and ensuring equitable access to essential pharmaceuticals for all Canadians.

Congratulations to all of our dedicated members who have been elected for positions on the 2014–2015 CANNT Board of Directors. The incoming Board will be introduced during the Annual General Meeting on Friday, October 24, in Niagara Falls. The recipients of CANNT's awards and bursaries will also be announced at the AGM during the Awards Ceremony portion of the meeting.

On Wednesday, September 17, 2014 we will celebrate Nephrology Professionals Day. This is a time to acknowledge one another for our contributions that enhance the quality of life for those in our care. I encourage you to share your celebration activities and pictures via the CANNT website or Facebook page.

In closing, we are specialists possessing a wealth of knowledge. Through sharing at our annual conference, via the website, and the online journal, as active members of our association, we begin a domino effect that carries on throughout the nephrology community. I encourage each of you to continue to learn every day and watch your investment grow as you celebrate your successes.

I look forward to meeting you at CANNT 2014!

Roberta Prettie, CANNT
President 2013-2014

Célébrez vos réalisations

Benjamin Franklin a déclaré : « l'investissement dans le savoir est celui qui rapporte le plus d'intérêts. »

Félicitations aux 235 infirmières et infirmiers à l'échelle nationale qui ont investi dans leur savoir et ont obtenu leur certification de l'Association des infirmières et infirmiers du Canada (AIIC) dans le domaine de la néphrologie au printemps. Vos efforts et votre dévouement à votre spécialisation sont remarquables. Le domaine de la néphrologie est l'une des vingt spécialisations qui offrent une certification par l'entremise de l'AIIC. Afin d'appuyer la certification de l'AIIC, un atelier de préparation sera offert le jeudi 23 octobre lors du symposium de l'ACITN de 2014, à Niagara Falls, en Ontario. Cet atelier profitera à tous ceux qui souhaitent s'inscrire à l'examen de l'AIIC.

L'AIIC est la voix professionnelle nationale des infirmières et des infirmiers autorisés du Canada. Elle appuie les meilleures pratiques et fait la promotion de la profession d'infirmière. En tant qu'association, elle fait également pression auprès du gouvernement afin qu'il adopte des politiques sur la santé qui profiteront au mieux à tous les Canadiens et Canadiennes.

À titre d'agente de liaison de l'AIIC pour l'ACITN, j'ai eu la chance de participer au congrès biennal de l'AIIC qui a eu lieu à Winnipeg, au Manitoba du 16 au 18 juin 2014. Cette expérience d'apprentissage s'est révélée différente et motivante pour moi, car elle touchait les politiques sur la santé plutôt que la pratique clinique. Lors de l'assemblée générale annuelle, des résolutions ont été adoptées afin de permettre à l'AIIC de se conformer à la Loi canadienne sur les organisations à but non lucratif. De nombreuses autres résolutions ont été présentées et débattues avec enthousiasme avant d'être adoptées, demandant ainsi à l'AIIC qu'elle fasse pression sur le gouvernement. Selon moi, deux des résolutions adoptées auront un effet important sur les patients atteints de troubles rénaux, si la pression auprès du gouvernement réussit. Ces résolutions sont : l'amélioration de l'équité en matière de santé chez les peuples autochtones, et l'assurance d'un accès équitable aux produits pharmaceutiques essentiels pour tous les Canadiens et Canadiennes.

Félicitations à tous nos membres dévoués qui ont été élus pour le conseil d'administration de l'ACITN de 2014-2015. Le prochain conseil sera présenté lors du congrès annuel qui aura lieu le vendredi 24 octobre à Niagara Falls, en Ontario. Les lauréats des prix et des bourses de l'ACITN seront annoncés lors de la remise des prix qui aura lieu pendant le congrès.

Le mercredi 17 septembre 2014, nous célébrerons la Journée des professionnels de la santé en néphrologie. C'est le moment de prendre connaissance de nos contributions à l'amélioration de la qualité de vie de nos patients. Je vous invite à partager vos activités et vos photos par l'entremise du site Web ou de la page Facebook de l'ACITN.

En conclusion, n'oublions pas que nous sommes des spécialistes possédant de riches connaissances. Grâce à notre partage, en tant que membres actifs de notre association, lors du symposium annuel, ou par l'entremise du site Web ou du journal électronique, nous réalisons un effet domino qui se répercute dans l'ensemble de la communauté néphrologique. Je vous invite à continuer à enrichir votre savoir quotidiennement et à observer la croissance de votre investissement alors que vous célébrez vos réalisations.

Au plaisir de vous voir au symposium de l'ACITN de 2014!

Roberta Prettie, présidente de l'ACITN 2013-2014

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- September 17, 2014. Nephrology Health Care Professionals Day.
- October 11–13, 2014. ANNA Fall Meeting for Nephrology Nurses, Managers, and Advanced Practice Nurses, Westin Savannah Harbor Resort & Spa, Savannah, Georgia. Website: **www.annanurse.org**
- October 23–25, 2014. CANNT 47th National Symposium, "Pursuing the Power Within", Niagara Falls, Ontario. Website: **www.cannt.ca**

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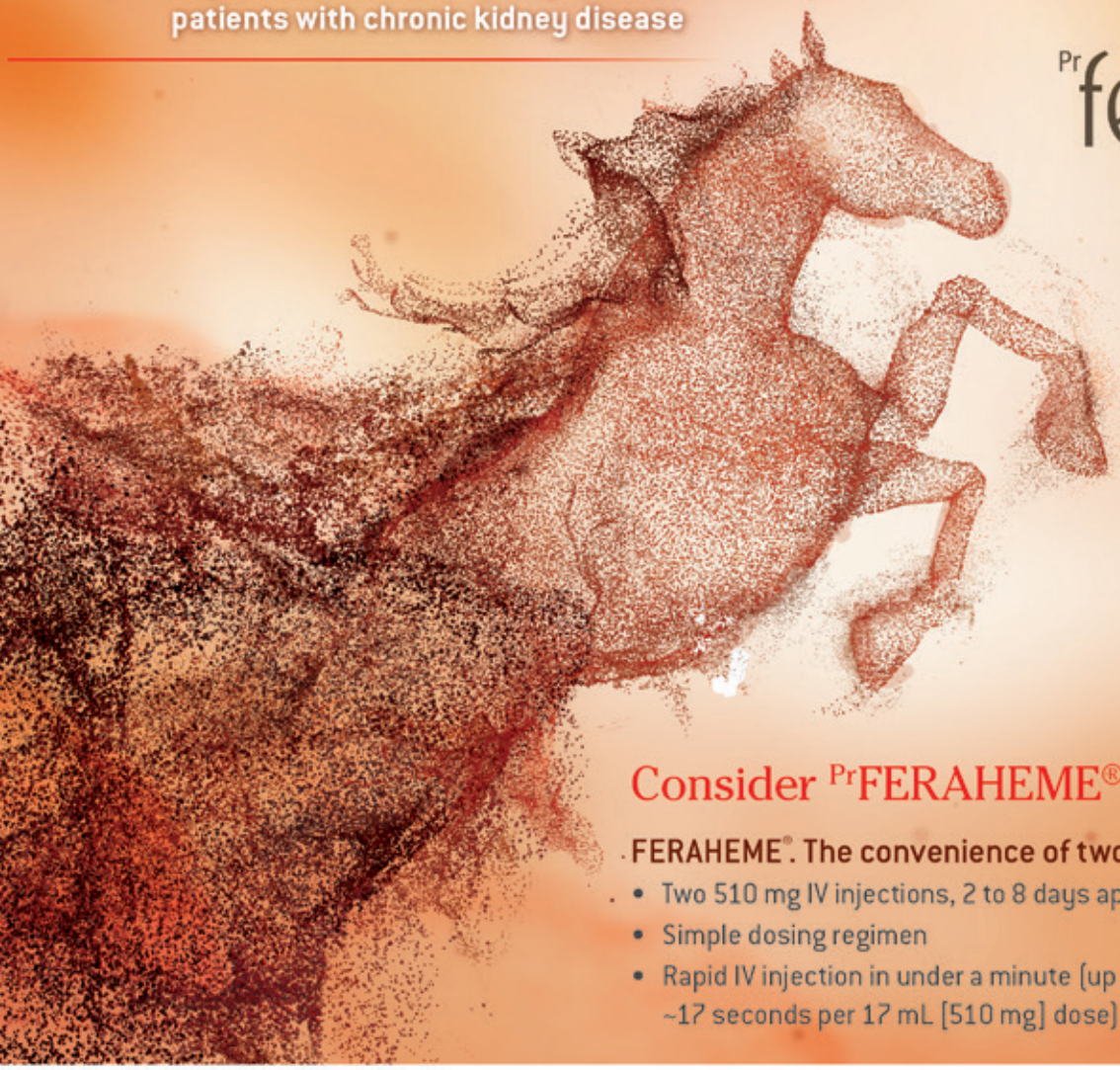

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Reference: 1. FERAHEME™ Product Monograph. Takeda Canada Inc.


Nephrology Healthcare Professionals Day
Wednesday
September 17, 2014
How many times in a day does a nephrology healthcare professional rely on their fellow team members?
Take this day to remind each other of how much we appreciate every member of the team.
On a daily basis across Canada, consultation occurs amongst many professionals. Check their websites:
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Journée des professionnels de la santé en néphrologie
Le mercredi septembre 17 2014
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Recent Changes in Anemia Management: The Kidney Disease Improving Global Outcomes (KDIGO) Anemia Guideline versus the Canadian Society of Nephrology (CSN)

By Lori Harwood, RN(EC), PhD (candidate), Lori Wazny, BScPharm, PharmD and Jo-Anne Wilson, BScPharm, ACPR, PharmD

OBJECTIVES

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

1. Define the recommended hemoglobin and iron target levels for people with Chronic Kidney Disease (CKD).
2. Compare and contrast currently available medications to manage anemia in patients with CKD.
3. Implement the anemia management guidelines into their clinical practice sites.

ABSTRACT

The management of anemia is important for health outcomes for people with chronic kidney disease (CKD). Global evidenced-based guidelines must be placed in the Canadian context to be relevant to guide practice. This paper summarizes the response of the Canadian Society of Nephrology to global anemia management guidelines in CKD and the implications for practice.

Keywords: anemia, chronic kidney disease, best practice guidelines

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INTRODUCTION

The most common causes of anemia for people with Chronic Kidney Disease (CKD) are iron deficiency and low erythropoietic activity (KDIGO, 2012). Important components of the management of anemia for CKD are the use of erythropoietin stimulating agents (ESAs) and iron therapy. The Kidney Disease Improving Global Outcomes (KDIGO) Anemia Guideline was published in 2012. The KDIGO guideline provides a broad international perspective to anemia management which must be incorporated into the Canadian context to be useful for practitioners in Canada. As a result, the Canadian Society of Nephrology (CSN) formed a working group with the purpose of adapting the KDIGO recommendations to the Canadian health care system (Moist et. al., 2013). The purpose of this article is to highlight the recent changes in the management of anemia of CKD by discussing the differences between the KDIGO guideline for anemia management and the CSN commentary on this guideline.

TARGETS FOR HEMOGLOBIN (HB) AND IRON

Suggested Hb and iron targets for adults and children with anemia of CKD from KDIGO and CSN are outlined in Tables 1 and 2, respectively. Of note, Hb targets have decreased from the 2008 CSN Anemia guideline recommendations of 100–120 g/L to the current recommendation of 95–115 g/L with a target of 100–110 g/L (Moist et al., 2013). This is the result of three recent major randomized controlled trials—Correction of Hemoglobin and Outcomes In Renal insufficiency (CHOIR), Cardiovascular Risk reduction in Early Anemia Treatment with Epoetin beta (CREATE), and Trial to Reduce cardiovascular Events with Aranesp Therapy (TREAT)—which provide evidence that there may be more risk than benefit at higher Hb targets (Drueke et al., 2006; Pfeffer et al., 2009; Singh et al., 2006).

The CHOIR study enrolled 1,432 CKD Stage 3–4 patients who were randomized to Hb targets of 135 g/L and 113 g/L using epoetin alfa. The achieved mean Hb values were 126 and 113 g/L. The study was stopped prematurely because significantly more patients in the high Hb group experienced the primary endpoint of myocardial infarction, stoke, death, or hospitalization for congestive heart failure. As well, no difference in quality of life was observed between the two groups (Singh et al., 2006).

Table 1: Hb and Iron Targets in Children with Anemia of CKD: KDIGO versus CSN Commentary		
Parameter	**KDIGO**	**CSN Commentary**
Hb	Hb at which ESA therapy is started is individualized and considers potential benefits (e.g., improvement in QOL, school attendance/ performance, and avoidance of transfusion) and potential harms.	Agree
	For children on ESAs, target Hb range 110–120 g/L.	Agree
Iron indices	Oral iron (ND-CKD or PD) or IV iron (HD) if Tsat is ≤20% and ferritin is ≤100 ug/L	Agree
ND-CKD=Nondialysis chronic kidney disease		

CREATE enrolled 603 CKD Stage 3–5 patients to a high Hb target of 130–150 g/L versus a lower target of 105–115 g/L using epoetin beta. The achieved median Hb values were 135 g/L and 116 g/L. Dialysis was required in significantly more patients in the high Hb group and no improvement in cardiovascular endpoints was observed in the high Hb group (Drueke et al., 2006).

TREAT examined the primary endpoints of cardiovascular events or death and end stage kidney disease or death in 4,038 CKD Stage 3-4 patients making it the largest ESA trial to date (Pfeffer et al., 2009). TREAT also had the strongest research design because it was placebo-controlled and double-blinded (KDIGO, 2012). Patients received either darbepoetin alfa to a target Hb of 130 g/L or placebo with rescue doses of darbepoetin only if the Hb was less than 90 g/L. The achieved median Hb values were 125 g/L (interquartile range (IQR) 120–126 g/L) and 106 g/L (IQR 99–113 g/L). There was no difference in the primary endpoint of death, cardiovascular event or end-stage kidney disease (Pfeffer et al., 2009).

The current recommendation not to exceed a Hb of 115 g/L is a result of the fact that this was the upper limit of Hb in the control groups (lower target group) of these

Table 2: Hb and Iron Targets in Adults with Anemia of CKD: KDIGO versus CSN Commentary				
Parameter	**Nondialysis Patients**		**HD and PD Patients**	
	KDIGO	**CSN Commentary**	**KDIGO**	**CSN Commentary**
Hb	If Hb≥100 g/L, do not initiate ESA If Hb<100 g/L consider rate of fall of Hb, prior response to iron, risk of needing a transfusion, risk of ESA therapy, and presence of anemia symptoms before initiating an ESA. Suggest not to use ESAs to maintain Hb >115 g/L but individual patients may have improved QOL at Hb>115 g/L & will be prepared to accept the risks.	Agree Agree For patients on ESAs: Hb range = 95–115 g/L with a target of 100-110 g/L. Do not use ESAs to target Hb>115 g/L as impact on QOL and adverse events is uncertain.	Initiate ESA when Hb is between 90–100 g/L. Avoid Hb<90 g/L. Suggest not to use ESAs to maintain Hb >115 g/L but individual patients may have improved QOL at Hb>115 g/L & will be prepared to accept the risks.	For patients on ESAs: Hb range = 95–115 g/L with a target of 100–110 g/L. Do not use ESAs to target Hb>115 g/L as impact on QOL and adverse events is uncertain.
Iron indices	Give a 1–3 month trial of oral iron if TSAT is ≤30% and ferritin is ≤500 ug/L. No upper limit for TSAT or ferritin is provided due to limited evidence. Dose = 200 mg elemental iron daily. Ferrous sulfate suggested as there is no evidence that other oral iron formulations are more effective or associated with fewer adverse side effects.	Administer iron to maintain TSAT>20% and ferritin >100 ug/L. An ↑ in Hb is less likely when TSAT>30% and ferritin>500 ug/L. Agree Oral iron formulations not discussed.	IV iron if TSAT is ≤30% and ferritin is ≤500 ug/L No upper limit for TSAT or ferritin is provided due to limited evidence.	Administer iron to maintain TSAT>20% and ferritin >200 ug/L (HD) or >100 ug/L (PD). An ↑ in Hb is less likely when TSAT>30% and ferritin>500 ug/L. Agree

trials. However, the KDIGO anemia guideline goes on to state that "individualization of therapy will be necessary as some patients may have improvements in quality of life at Hb concentration above 115 g/L and will be prepared to accept the risks" (KDIGO, 2012 p.303) but the risk associated in targeting Hb levels in the 115 g/L to 120 g/L range remains unknown as Hb values in this range were not studied in the CHOIR, CREATE, or TREAT trials. The CSN commentary strongly disagreed with this KDIGO suggestion because the impact on quality of life at Hb values greater than 115 g/L is negligible, in the range of a placebo effect, and adverse effects such as death and risk of hemodialysis access thrombosis are unknown (KDIGO, 2012; Moist et al., 2013).

The lower limit of Hb as per KDIGO (2012) is 90 g/L based on the TREAT trial protocol. In contrast, the CSN commentary recommends 95 g/L. The slightly higher CSN recommendation came from a concern regarding increased risk of blood transfusions if the lower Hb level was set at 90 g/L (Moist et al., 2013).

Special Populations

Table 3 outlines the KDIGO and CSN Commentary recommendations for special populations.

STROKE AND TRANSIENT ISCHEMIC ATTACKS (TIA)

The TREAT trial demonstrated a significantly increased risk of stroke in the high Hb group (HR 1.92, 95% CI 1.38–2.68) (Pfeffer et al., 2009). The absolute risk of stroke was much higher in patients with a history of stroke or TIA in the high Hb arm of the study (8% vs. 1% in those without a history of stroke) (Skali et al., 2011; Solomon et al., 2010). A significantly increased risk of stroke was also observed in a Canadian hemodialysis population randomized to a Hb target of 135–145 g/L (4% absolute risk) versus a lower Hb group of 95–115 g/L (1% absolute risk) (Parfrey et al., 2005). Therefore the guidelines recommend not using ESAs to maintain Hb levels greater than 115g/L (KDIGO, 2012; Moist et al., 2013).

Table 3: Special Populations Recommendations

Population	KDIGO	CSN*
Stroke or TIA history	Use with great caution	May be used. Initiate ESA at Hb of 90 g/L and aim for a Hb range = 90–105 g/L**
Cancer (active malignancy)	Use with great caution, if at all	Use with caution, if ever.
Cancer (history)	Use with great caution, if at all	May be used. Initiate ESA at Hb of 90 g/L and aim for a Hb range = 90–105 g/L.

*Use of ESA should occur only after discussion with patients at risk who have been informed of the increased risk of stroke and cancer mortality associated with ESA use and the risks of transfusion therapy.
** Hb recommendations are consistent with the control arm of the TREAT trial.

CANCER

A post-hoc analysis of the TREAT trial found that 7.4% of those with a history of malignancy at baseline died from cancer in the darbepoetin arm compared to 0.6% in the placebo arm (p=0.002) (Pfeffer et al., 2009). As a result, both the KDIGO and CSN recommend using ESAs with caution—if at all—in patients with an active malignancy (see Table 3).

Controlled trials in patients with head and neck cancer receiving radiotherapy only, non-small cell lung cancer, cervical cancer, and breast cancer receiving chemotherapy for metastatic disease have demonstrated a significantly increased risk of mortality (HR = 1.17, 95% CI 1.04–1.31) when ESAs are used (Grant, Piper, & Bohlius, 2013). However, several different meta-analyses have failed to show that disease progression or tumor response rates are different in patients who do versus who do not receive ESAs and a Cochrane review in 2012 that was limited to patients with chemotherapy-induced anemia failed to find a significant adverse impact of ESAs in on-study or overall mortality (Tonia et al., 2012).

The reason for this adverse effect of ESAs is not clear. Proposed mechanisms include acceleration of tumour growth related to higher Hb levels; the presence of erythropoietin receptors on the surface of tumour cells, which may promote angiogenesis, tumor growth, tumor cell survival, and/or resistance to treatment; but laboratory and clinical studies have not been able to conclusively demonstrate this. Alternatively, it may be that indirect effects of ESAs such as endothelial cell and platelet activation with resulting neovasculogenesis may contribute to tumour growth (Aapro, Jelkmann, Constantinescu, & Leyland-Jones, 2012).

Iron Administration and Frequency of Monitoring

There are four intravenous (IV) iron products available in Canada: Iron Dextran (Infufer [Sandoz Canada Inc.], DexIron [Lutipold Pharmaceuticals Inc.]), Iron Sucrose (Venofer [Genpharm Inc.]), Sodium Ferric Gluconate (Ferrlecit [Sanofi-Aventis Canada Inc.]) and Ferumoxytol (Feraheme [Takeda Canada Inc.]). Table 5 outlines select properties and the recommended dose and administration of IV irons for repletion of iron deficiency. Table 6 outlines timing between IV iron administration and iron study follow-up testing.

Any type of IV iron may cause hypersensitivity or other reactions and in rare cases life-threatening adverse drug events (ADEs) (Chertow et al., 2006; Coppol et al., 2011; Hayat, 2008). Previous studies have compared rates of

Table 4: ESA Route of Administration Recommendations for Patients receiving Hemodialysis

ESA	KDIGO	CSN Commentary
Epoetin alfa (Eprex)	IV or subcutaneous	subcutaneous only*
Darbepoetin alfa (Aranesp)	IV or subcutaneous	Agree

*patients who experience severe pain or bruising with subcutaneous injections due to cachexia, thrombocytopenia, or other disorders may receive IV epoetin alfa

Table 5: Comparison of Intravenous (IV) Iron Therapies				
Brand Name	**Infufer® DexIron**	**Venofer®**	**Ferrlecit®**	**Feraheme®**
Proper Name	Iron Dextran	Iron Sucrose	Sodium Ferric Gluconate	Ferumoxytol
Indication	Treatment of IDA in CKD patients	Treatment of IDA in ND-CKD, HD and PD patients receiving ESA or ND-CKD patients not receiving ESA	Treatment of IDA in HD patients receiving ESA	Treatment of IDA in CKD patients
Composition	Complex of ferric hydroxide and dextran	Complex of polynuclear iron hydroxide in sucrose	Ferric oxide hydrate bonded to sucrose chelates with gluconate	Superparamagnetic iron oxide coated with a polyglucose sorbitol carboxymethyl-ether shell
Common Adverse Effects	Hypotension, flushing, dizziness, nausea, vomiting , diarrhea, headache, pruritus, injection site pain/reaction, cramps, pain (chest, arm, abdominal, back), dysgeusia (more common with Venofer®), fever, myalgia, arthralgia			
Precautions	In the following patients only use IV irons if the benefit outweighs the potential risk: immune or inflammatory conditions (e.g. systemic lupus erythematosus, rheumatoid arthritis); history of severe asthma, eczema or other atopic allergy. Feraheme® may transiently affect the diagnostic ability of MRI for up to 3 months (maximum effect is 1–2 days post infusion). Feraheme is contraindicated in patients with any allergy to other parenteral iron products or in patients with multiple (two or more) drug allergies. Clinicians should remember to differentiate between a true drug allergy versus a drug intolerance/side effect.			
Recommended Dose and Administration For Repletion of Iron Deficiency * This section does not include the complete dosing and administration information. Please see the respective product monographs.	IV Infusion: First therapeutic dose: Test dose of 25 mg IV administered slowly over at least 5 minutes (at a rate of not more than 5 drops per minute) diluted in 50 mL of 0.9% NaCl for injection (or the 25 mg dose may be administered as a partial dose from the prepared infusion bag). Wait at least 1 hour before continuing with remainder of dose to ensure reaction does not occur. Larger doses can be given in larger volume over longer infusion time. IM Injection: Recommended to be given as a graded series of injections starting with a test dose of 25 mg (0.5 mL), 50 mg (1 mL) then 100 mg (2 mL), Administer gradually (daily to 1–2 /week depending on patient activity level) by deep IM injection in upper outer quadrant of the buttock, using Z-track technique.	HD: 10 x 100 mg/ consecutive HD sessions administered as a slow IV injection undiluted over 2 to 5 minutes or as an IV infusion over a period of at least 15 minutes (diluted in 100 mL of 0.9% NaCl for injection) or larger doses may be given in larger volume over longer infusion time. PD: 2 x 300 mg IV infusions over 1.5 hours 14 days apart followed by 400 mg infusion over 2.5 hours 14 days later (3 divided doses in a 28 day period) ND-CKD: 5 x 200 mg in 14 days as a slow IV injection undiluted over 2 to 5 minutes on 5 different occasions within the 14 day period. There is limited experience with administration of an infusion of 500 mg of Venofer diluted in 250 mL maximum of 0.9% NaCl for injection over 3.5 to 4 h on day 1 and day 14. A longer infusion time or lower dose may be required by patients < 70 kg.	8 x 125 mg/ consecutive HD session administered as a slow IV injection undiluted at a rate of up to 12.5 mg/min over approximately 10 min or as an IV infusion over 1 hour (diluted in 100 mL of 0.9% NaCl for injection). There is limited experience with administration of an infusion of 250 mg.	2 x 510 mg every 2–8 days, administered undiluted IV at a rate of up to 1 mL/sec (30 mg/sec) over at least 17 seconds. Note: several Canadian programs have decided to administer over 1–5 min.
Most CKD patients will require a minimum cumulative dose of 1,000 mg of elemental iron over sequential sessions and may continue to require IV iron therapy at the lowest dose necessary to maintain target Hb and iron storage parameters (TSAT and Ferritin)				
Monitoring Post-infusion - NEW	Observe patients for signs and symptoms of hypersensitivity for at least 30 minutes following each IV iron administration. IV iron product monographs recommend IV irons should only be administered when personnel and therapies are immediately available for the treatment of anaphylaxis and other hypersensitivity reactions			
Available Dosage Form	Each 2 mL or 5 mL vial contains 50 mg/mL elemental iron	Each 5 mL vial contains 100 mg of elemental iron (20 mg/mL)	Each 5 mL ampoule contains 62.5 mg of elemental iron (12.5 mg /mL)	Each 17 mL vial contains 510 mg of elemental iron (30 mg/mL)

ADEs with the different IV iron products using data from registries or by comparing ADEs collectively from observational or clinical trials (Anirban et al., 2008; Aronoff, 2004; Auerbach & Al Talib, 2008; Auerbach & Ballard, 2010; Auerbach & Kane, 2012; Bailie, 2012; Ballie, Clark, Lane, & Lane, 2005; Ballie, Hori, & Verhoef, 2011; MacDougall et al., 2011; Schwenk, 2010). Extrapolation of incidence rates from registry-based research has several limitations, including lack of differentiation of first versus subsequent dose and severity of reaction. Head to head safety trials comparing IV iron products are needed.

Table 6: Comparison of Timing of Intravenous Iron Administration and Measurement of Iron Studies

IV Iron	Timing of Ferritin and TSAT Retest
Iron Dextran (Infufer, Dextran)	25 to 125 mg maintenance dosing and 500 mg infusions: 7 days post dose 1 g includes 10 to 100 mg loading doses: 14 days post dose
Iron Sucrose (Venofer)	48 h post dose
Sodium Ferric Gluconate (Ferrlecit)	125 mg maintenance dosing: 7 days post dose
Ferumoxytol (Feraheme)	510 mg—2 doses given 3 days apart: 14 days to 1 month after 2nd dose

It is difficult to determine if ADEs to IV iron are related to an allergic or hypersensitivity reaction or associated with the rapid release of labile or free iron. The nature and frequency of adverse drug events associated with IV iron administration is debatable. There is no strong evidence to extend the post-observation monitoring period from 30 to 60 minutes as suggested by KDIGO (2012). Table 7 outlines cautions regarding IV iron therapy in the KDIGO Guideline and CSN Commentary.

IMPLICATIONS FOR HOME HEMODIALYSIS (HHD)

In January 2013, Canadian product monographs were modified for iron dextran, iron sucrose and sodium ferric gluconate to include a 30 minute post-infusion monitoring period for each dose. Canadian labelling recommendations

Table 7: Cautions Regarding IV Iron Therapy: KDIGO versus CSN Commentary

Parameter	KDIGO	CSN
IV Iron Therapy Cautions	With the initial dose of IV iron, suggested a 60 minute post-infusion monitoring period and resuscitative facilities (including medications) and personnel trained to evaluate and treat serious adverse reactions.	Agree, except no strong evidence to extend post-infusion monitoring period from 30 to 60 minutes.

Figure 1: Home HD Patient Letter Template For New Labelling Changes For Administering IV Irons

Home Hemodialysis Patient Administering Intravenous Iron

This is a letter to inform you that Health Canada has requested labelling changes for all intravenous (IV) iron therapies in Canada. Intravenous iron is a supplement that is given intravenously to patients with anemia of kidney disease to help boost the body's iron stores, so there is more iron available to make red blood cells. Adverse reactions may occur with all IV iron products and generally occur within 30 minutes of completion of the IV iron. Adverse reactions range from mild to severe. Although very rare, anaphylactic shock (trouble breathing, swelling, drop in blood pressure, severe hives) has been reported worldwide.

The labelling changes recommended by Health Canada for all intravenous irons include the following:

To monitor patients for signs and symptoms of adverse reactions for at least 30 minutes after completion of intravenous iron.

Intravenous iron should only be administered when personnel and therapies are immediately available for the treatment of anaphylactic shock and other hypersensitivity reactions.

Our home hemodialysis team, which includes doctors, nurses and pharmacists, feel that IV irons are still safe products to administer at home with appropriate precautions in place. If, as a home hemodialysis patient, you would like to continue to administer this medication from your home setting, we will support you, but you must be aware of the new labelling change issued by Health Canada. To ensure you understand and comprehend this labelling change, we will need to review this information with you, and if we both agree it is safe to continue with at-home use of IV iron, we will document our conversation in your chart, stating that you are comfortable, and in fact prefer, administering IV irons in your home. Our discussion will also include education about the appropriate steps and medication (Epipen®) required in the rare case that an anaphylactic shock occurs. We will teach you how to safely use an Epipen® auto-injector, and we will also provide a prescription for an Epipen®.

We understand some patients may not feel comfortable administering IV iron at home. For those patients who prefer to have a Registered Nurse administer this product, we will make arrangements in a medical facility.

For any further questions or concerns, please do not hesitate to contact a member of your hemodialysis team.

Adapted with permission from University Health Network and CDHA Renal Program. Author Janice Ritchie, Clinical Manager, University Health Network, Toronto, ON

for the newer IV iron, ferumoxytol, also included a 30 minute observational period following injection. Product monograph changes also included a statement that the administration of IV iron should be undertaken when personnel and resuscitative interventions are immediately available for the treatment of serious hypersensitivity reactions. This created challenges for IV iron administration in hemodialysis units outside a hospital setting and in home hemodialysis programs.

Some centres have elected to have patients receiving HHD continue to administer their IV iron at home while other centres require patients to come into a medical facility to receive IV iron. Physicians, in consultation with individual patients and after obtaining informed consent, may choose to continue with the practice of IV iron at home provided the patient understands and accepts the risk of administering their IV iron. This approach should be discussed with the risk management group of the hospital prior to adoption. For these patients, education should be provided about the appropriate steps and medication (e.g. Epipen®) required in the rare case that a serious hypersensitivity reaction occurs. Figure 1 outlines a HHD patient consent letter that addresses the new labelling changes for administering IV irons.

Figure 2: Potentially Correctable Factors Involved in ESA Hyporesponsiveness

Potentially Correctable Factors

- Iron Deficiency
- Vitamin B_{12}/Folate Deficiency
- Hypothyroidism
- ACE-I/ARB Therapy
- Non-Compliance for Patient Self-Administration of ESA Therapy
- Infection/Inflammation
- Underdialysis
- Blood Loss
- Hyperparathryoidism
- Malnutrition

ESA Route of Administration for Patients Receiving Hemodialysis (Table 4)

Darbepoetin alfa (Aranesp®) dosing is not different between the IV and subcutaneous routes of administration, hence, both KDIGO (2012) and CSN (Moist et al., 2013) recommend that this can be administered by either route. In contrast, epoetin alfa (Eprex®) administered by the IV route results in increased doses of 13% to 26% based on past Canadian studies, which results in significantly increased drug cost (Moist et al., 2013). Cost reductions of $1,135 to $ 2,817 per patient per year have been reported just by changing to the subcutaneous route of epoetin alfa administration (Tonelli et al., 2008; Wazny, Raymond, Sood, Eng, & Verrelli, 2013). Prior to 2002, most Canadian hemodialysis units administered epoetin alfa by the subcutaneous route but due to a peak in incidence of pure red cell aplasia, believed to be associated with subcutaneous administration, most units switched to the IV route at that time. It was subsequently discovered that leachates from the epoetin alfa rubber stoppers may have contributed to the increase in pure red cell aplasia and, after the Canadian product was reformulated, the rates of pure red cell aplasia returned to baseline levels (Macdougall et al., 2012). However, many Canadian hemodialysis centres still continue to administer epoetin alfa via the IV route. The CSN commentary differs from KDIGO in that only the subcutaneous route is recommended for epoetin alfa due to significantly reduced drug costs from lower doses. For those programs looking to optimize cost savings with epoetin alfa and follow the CSN recommendations, the Manitoba Renal Program recently published their process on switching to subcutaneous epoetin alfa administration in their in-centre hemodialysis population (Wazny et al., 2013).

ESA Hyporesponsiveness

Approximately 15% of patients with chronic kidney disease demonstrate hyporesponsiveness to ESAs (Klarenbach et al., 2008). The term ESA hyporesponsiveness has been characterized using various definitions. The CSN working group agreed with the definition provided by KDIGO,

Table 8: ESA Hyporesponsiveness: KDIGO versus CSN Commentary

Parameter	KDIGO	CSN
Initial ESA Hyporesponsiveness	Classify patients as ESA hyporesponsiveness if there is no increase in Hb concentration from baseline after the first month of ESA treatment on appropriate weight-based dosing. Avoid repeated escalations in ESA dose beyond double the initial weight-based dose.	Agree; some uncertainty in definition of ESA hyporesponsiveness.
Subsequent ESA Hyporesponsiveness	Classify patients as subsequent ESA hyporesponsiveness if after treatment at stable doses of ESA, they require 2 increases in ESA doses up to 50% beyond the dose at which they had been stable. Avoid repeated escalations in ESA dose beyond double the dose at which they have been stable.	Agree, in the absence of definitive clinical trials of hyporesponders, and given the safety concern with higher Hb targets, a maximum weekly dose of ESA seems prudent (i.e. epoetin alfa 24,000 units/week or darbepoetin 80 mcg/week).Recommends systems and protocols to identify and review patients receiving high dose ESA therapy.

which was derived from the secondary analysis of the TREAT study (Solomon et al., 2010). Table 8 summarizes the KDIGO and CSN recommendations for initial and subsequent ESA hyporesponsiveness.

Concerns regarding ESA hyporesponsiveness remain the subject of much interest. Recent post hoc analyses of the CHOIR study have suggested cardiovascular toxicity might be due to high doses of ESAs (Kaufman, 2011; McCullough et al., 2013). In the CHOIR study, subcutaneous epoetin alfa doses of greater than 10,095 units per week were associated with increased risks for cardiovascular events (McCullough et al., 2013). In addition, data from the United States Renal Data System (USRDS) have shown higher doses of epoetin alfa to be an independent predictor of mortality with the greatest increase in risk in patients receiving >18,800 units per week (Zhang, Thamer, Stefanik, Kaufman, & Cotter, 2004). Other post hoc analyses, observational studies, systematic reviews, meta-analysis and metaregression analyses suggest that higher hemoglobin targets and/or escalating ESA doses are associated with higher mortality rate and strokes (Drueke et al.,2006; Koulouridis et al., 2013; Pfeffer et al., 2009; Singh et al., 2006; Solomon et al., 2010; Szczech et al., 2008). However, these risks still need to be proven in prospective randomized controlled trials. In the meantime, identifying and reviewing patients receiving high-dose ESAs is paramount.

The CSN working group provided recommended dosing regimens for epoetin alfa (Eprex®) and darbepoetin alfa (Aranesp®) and suggested a maximum weekly dose of ESAs. For example, in an 80-kg person, given that the suggested starting dose of epoetin alfa is 20–50 units/kg/week or darbepoetin alfa 0.45 mcg/kg/week; this would equate to 1,600 to 4,000 units thrice weekly of epoetin alfa or 40 mcg/week of darbepoetin alfa. The recommended maximal dose would be in the range of epoetin alfa—9,600 to 24,000 units per week, or darbepoetin alfa—80 mcg/week (Moist et al., 2013).

Learning how best to manage patients exhibiting ESA hyporesponsiveness is critically important to avoiding adverse events and minimizing the high cost of ESA therapy. Renal programs need to determine how they will meet these guidelines, such as with the use of algorithm/systems for monitoring, dosing and management of patients with ESA hyporesponsiveness. The Canadian Kidney Knowledge Translation and Generation Network (www.CANN-NET.ca) is a working group of the CSN that has developed an anemia algorithm to assist health care teams with the dissemination of the update guideline (Moist et al., 2013). Figure 2 outlines potentially correctable factors involved in ESA hyporesponders.

IMPLICATIONS FOR PRACTICE

In summary, the CSN Anemia Commentary (Moist et al., 2013) recommended all patients with CKD, including those receiving dialysis, achieve a target Hb of 100–110 g/L with a range of 95–115g/L. Transferrin saturation (TSAT) levels should be greater than 20% and ferritin greater than 200 ug/L for patients receiving HD or greater than 100 ug/L for those receiving PD. There is likely no Hb-specific benefit to increasing TSAT values to greater than 30% or ferritin greater than 500 ug/L. The new administration and monitoring recommendations for IV iron administration have already necessitated changes to home hemodialysis programs and satellite dialysis units outside of the hospital setting.

Special consideration before initiating or continuing an ESA must to be given to people with previous TIA/stroke, active malignancy or a history of cancer. In these situations ESAs may be used with great caution at lower Hb targets or may not be used, instead relying on iron therapy and blood transfusions to manage anemia. Management of ESA hyporesponsiveness can be challenging in the clinical setting but maximum ESA dose recommendations are provided and all patients receiving ESA doses in excess of these recommendations should be reviewed by the health team. Renal health care teams should also discuss implementing the CANN-NET anemia algorithm which follows the CSN recommendations. In conclusion, this paper summarizes the recent KDIGO and CSN guidelines in order for clinicians to understand recent changes in the practice of anemia management, and the differences between these two guideline documents.

REFERENCES

Aapro, M., Jelkmann, W., Constantinescu, S.N., Leyland-Jones B. (2012). Effects of erythropoietin receptors and erythropoiesis-stimulating agents on disease progression in cancer. *British Journal of Cancer, 106*, 1249.

Anirban, G., Kohli, H.S., Jha, V., Gupta, K.L., & Sakhuja, V. (2008). The comparative safety of various intravenous iron preparations in chronic kidney disease patients. *Renal Failure*, 30, 629-38.

Aronoff, G.R., (2004). Safety of intravenous iron in clinical practice: Implications for anemia management protocols. *Journal of the American Society of Nephrology,* 15, S99-106.

Auerbach, M., & Al Talib, K. (2008). Low-molecular weight iron dextran and iron sucrose have similar comparative safety profiles in chronic kidney disease. *Kidney International*, *73,* 528-30.

Auerbach, M., & Ballard, H. (2010). Clinical use of intravenous iron: Administration, efficacy and safety. *American Society of Hematology Education Program,* 338-47. doi: 10.1182/asheducation-2010.1.338. Review.

Auerbach, M., & Kane, R.C. (2012). Caution in making inferences from FDA's Adverse Event Reporting System. *American Journal of Health-System Pharmacy*, 69, 922-3.

Bailie, G.R. (2012). Comparison of rates of reported adverse events associated with intravenous iron products in the United States. *American Journal of Health System Pharmacy*, 69, 310-20.

Bailie, G.R., Clark, J.A., Lane, C.E., & Lane, P.L. (2005). Hypersensitivity reactions and deaths associated with intravenous iron preparations. *Nephrology Dialysis Transplantation*, 20, 1443-9.

Bailie, G.R., Hori, W.H., & Verhoef, J.J. (2011). Differences in spontaneously reported hypersensitivity and serious adverse events for intravenous iron preparations: Comparison of Europe and North America. *Arzneimittelforschung*, 61, 267-75.

Chertow, G.M., Masson, P.D., Vaage-Nilsen, O., Ahlmen, J. (2006). Update on adverse drug events associated with parenteral iron. *Nephrology Dialysis Transplantation*, 21, 378-82.

Coppol, E., Shelly, J., Cheng, S., Kaakeh, Y. & Shepler B. (2011). A comparative look at the safety profiles of intravenous iron products used in the hemodialysis population. *The Annuals of Pharmacotherapy,* 45, 241-7.

DexIron™ [product monograph]. Luitpold Pharmaceuticals, Inc., Mississauga, Ontario; January 2013.

Drueke, T.B., Locatelli, F., Clyne, N., Eckardt, K.U., Macdougall, I.C., Tsakiris, D. … Scherhag, A. CREATE Investigators. (2006). Normalization of hemoglobin level in patients with chronic kidney disease and anemia. *The New England Journal of Medicine, 355*(20), 2071-2084. doi:10.1056/NEJMoa062276

Feraheme® [product monograph]. Takeda Canada Inc., Oakville, Ontario; February 2013.

PRFerrlecit [product monograph]. Sanofi-Aventis Canada Inc., Laval, Quebec; January 2013.

Grant, M., Piper, M. & Bohlius, J. (2013). *Comparative effectiveness review number 113: Epoetin and darbepoetin for managing anemia in patients undergoing cancer treatment: Comparative effectiveness update.* Retrieved 12/27, 2013, from http://effectivehealthcare.ahrq.gov/ehc/products/170/1480/cancer-anemia-treatment-report-130425.pdf

Hayat, A. (2008). Safety issues with intravenous iron products in the management of anemia in chronic kidney disease. *Clinical Medical Research* 6, 93-102.

Infufer® [product monograph]. Sandoz Canada Inc., Boucherville, Quebec; December 2012.

Kaufman, J.S. (2011). Relationship of erythropoiesis-stimulating agent dose and responsiveness and adverse outcomes in CKD. *American Journal of Kidney Diseases, 57*(5), 661-663.

Kidney Disease: Improving Global Outcomes (KDIGO) Anemia Work Group. (2012). KDIGO clinical practice guideline for anemia in chronic kidney disease. *Kidney Inter., Suppl., 2*, 279-335.

Klarenbach, S.W., Moist, L.M., Foley, R.N., Barrett, B., Madore, F., White, C.T. … Manns, B. (2008). Clinical practice guidelines for supplemental therapies and issues. Kidney International Supplement. S19-S24.

Koulouridis, I., Alfayez, M., Trikalinos, T.A., Balk, E.M., & Jaber, B.L. (2013). Dose of erythropoiesis-stimulating agents and adverse outcomes in CKD: A metaregression analysis. *American Journal of Kidney Diseases,* 61, 44-56.

MacDougall, I.C., McGlaughlin, J., Fortin, G.S. (2011). FIRST: head to head comparison study of the safety and efficacy of ferumoxytol with irons sucrose for the treatment of iron deficiency anemia in patients with chronic kidney disease. *Journal of the American Society of Nephrology, 22*, 6B Abstract.

Macdougall, I.C., Roger, S.D., de Francisco, A., Goldsmith, D.J., Schellekens, H., Ebbers, H… Pollock, C. (2012). Antibody-mediated pure red cell aplasia in chronic kidney disease patients receiving erythropoiesis-stimulating agents: New insights. *Kidney International, 81*(8), 727-732. doi:10.1038/ki.2011.500

McCullough, P.A., Barnhart, H.X., Inrig, J.K., Reddan, D., Sapp, S., Patel, U.D. … Califf, R.M. (2013). Cardiovascular toxicity of epoetin-alfa in patients with chronic kidney disease. *American Journal of Nephrology, 37*(6), 549-558.

Moist, L.M., Troyanov, S., White, C.T., Wazny, L.D., Wilson, J.A., McFarlane, P. … Manns, B.J. (2013). Canadian society of nephrology commentary on the 2012 KDIGO clinical practice guideline for anemia in CKD. *American Journal of Kidney Diseases.* doi. 1053/j.ajkd.2013.08.001

Parfrey, P.S., Foley, R.N., Wittreich, B.H., Sullivan, D.J., Zagari, M.J., & Frei, D. (2005). Double-blind comparison of full and partial anemia correction in incident hemodialysis patients without symptomatic heart disease. *Journal of the American Society of Nephrology, 16*(7), 2180-2189. doi:10.1681/ASN.2004121039

Pfeffer, M.A., Burdmann, E.A., Chen, C.Y., Cooper, M.E., de Zeeuw, D., Eckardt, K.U., TREAT Investigators. (2009). A trial of darbepoetin alfa in type 2 diabetes and chronic kidney disease. *The New England Journal of Medicine, 361*(21), 2019-2032. doi:10.1056/NEJMoa0907845

Schwenk, M.H. (2010). Ferumoxytol: A new intravenous iron preparation for the treatment of iron deficiency anemia in patients with chronic kidney disease. *Pharmacotherapy*, 30, 70-9.

Singh, A.K., Szczech, L., Tang, K.L., Barnhart, H., Sapp, S., Wolfson, M. … CHOIR Investigators. (2006). Correction of anemia with epoetin alfa in chronic kidney disease. *The New England Journal of Medicine, 355*(20), 2085-2098. doi:10.1056/NEJMoa065485

Skali, H., Parving, H.H., Parfrey, P.S., Burdmann, E.A., Lewis, E.F., Ivanovich, P. TREAT Investigators. (2011). Stroke in patients with type 2 diabetes mellitus, chronic kidney disease, and anemia treated with darbepoetin alfa: The trial to reduce cardiovascular events with aranesp therapy (TREAT) experience. *Circulation, 124*(25), 2903-2908. doi:10.1161/CIRCULATIONAHA.111.030411

Solomon, S.D., Uno, H., Lewis, E.F., Eckardt, K.U., Lin, J., Burdmann, E.A. … Pfeffer, M. (2010). Trial to Reduce Cardiovascular Events with Aranesp Therapy (TREAT) Investigators. Erythropoietic response and outcomes in kidney disease and type 2 diabetes. *The New England Journal of Medicine, 363*(12), 1146-1155.

Szczech, L.A., Barnhart, H.X., Inrig, J.K., Reddan, D.N., Sapp, S. … Singh, A.K. (2008). Secondary analysis of the Choir Trial epoetin-alpha dose and achieved hemoglobin outcomes. *Kidney International,74*, 791-8.

Tonelli, M., Klarenbach, S., Wiebe, N., Shrive, F., Hemmelgarn, B. & Manns, B. (2008). *Erythropoiesis-stimulating agents for anemia of chronic kidney disease: Systematic review and economic evaluation.* (No. Technology report number 106). Ottawa: Canadian Agency for Drugs and Technologies in Health (CADTH).

Tonia, T., Mettler, A., Robert, N., Schwarzer, G., Seidenfeld, J., Weingart, O. … Bohlius, J. (2012). Erythropoietin or darbepoetin for patients with cancer. *The Cochrane Database of Systematic Reviews, 12*, CD003407. doi:10.1002/14651858.CD003407.pub5

Venofer® [product monograph]. Genpharm Inc., Mississauga, Ontario; January 2013.

Wazny, L.D., Raymond, C.B., Sood, A.R., Eng, A., & Verrelli, M. (2013). Cost analysis of an intravenous to subcutaneous epoetin alpha conversion. *American Journal of Nephrology, 38*(6), 496-500.

Zhang, Y., Thamer, M., Stefanik, K., Kaufman, J., & Cotter, D.J. (2004). Epoetin requirements predict mortality in hemodialysis patients. *American Journal of Kidney Diseases: The Official Journal of the National Kidney Foundation, 44*(5), 866-876.

CONTACT HOUR: 2.0 HRS

Blood pressure management in patients on hemodialysis

By Stephanie Lynch, BScPharm, PharmD student, and Marisa Battistella, BScPharm, PharmD, ACPR

OBJECTIVES

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

1. Describe possible pathophysiological mechanisms of hypertension in patients on hemodialysis.
2. Identify potential treatment targets for hypertension in patients receiving hemodialysis.
3. Explain non-pharmacological methods for reducing blood pressure in patients on hemodialysis.
4. Compare pharmacological agents for the treatment of hypertension in the setting of hemodialysis.

INTRODUCTION

Hypertension is present in 50% to 90% of patients on hemodialysis (Santos & Peixoto, 2008). Results from randomized controlled trials suggest that in hypertensive patients undergoing hemodialysis, blood pressure lowering therapies are associated with a lower risk of cardiovascular events and mortality (Heerspink et al., 2009). However, the optimal blood pressure target and preferred antihypertensive agent have yet to be prospectively defined. This article will review a stepwise approach to the management of hypertension in patients on hemodialysis. Non-pharmacological methods for reducing blood pressure such as individualization of the dialysate sodium prescription and reduction in target weight will be highlighted. Recommendations for the use of various pharmacological agents for the treatment of hypertension will be provided based on their safety and efficacy in hemodialysis.

PATHOPHYSIOLOGY

There are four principal mechanisms of hypertension in patients on hemodialysis. Expanded extracellular fluid volume and increased total body sodium due to a reduction in sodium excretion is arguably the most important mechanism. Volume overload results in higher blood pressures through increased cardiac output and systemic vascular resistance (Salem, 1995). Activation of the sympathetic nervous system through activation of chemoreceptors in abnormal kidneys is a second contributing mechanism to hypertension in patients receiving dialysis. Finally, activation of the renin angiotensin-aldosterone (RAAS) system and increased arterial stiffness are two other mechanisms of hypertension in patients receiving hemodialysis. When blood volume is low (i.e. during ultrafiltration) the kidneys activate the RAAS. Activation of the RAAS occurs through the conversion of angiotensin I to angiotensin II via angiotensin converting enzyme (ACE). Angiotensin II (ATII) then binds to receptors in the kidneys, arterioles and on the pituitary gland. Binding of ATII results in increased blood pressure through several different mechanisms. Specifically, ATII causes increased sympathetic activity, sodium reabsorption and water retention, and arteriolar vasoconstriction. Arterial stiffness can result from calcification of arterial walls or nitric oxide deficiency that may in turn result in endothelial dysfunction and increased blood pressure (Agarwal, 2005). Various non-pharmacological and pharmacological treatments used in the management of hypertension work to counteract these mechanisms of hypertension and will be discussed in further detail.

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RATIONALE FOR TREATMENT

In the general population there is overwhelming evidence from prospective randomized trials demonstrating the cardiovascular benefits associated with lowering blood pressure to less than 140/90 mmHg in hypertensive individuals (Heerspink et al., 2009). In patients receiving hemodialysis, controversy exists regarding the benefits of blood pressure reduction and antihypertensive therapies with respect to cardiovascular outcomes. Observational studies suggest that lower blood pressures or a reduction in blood pressure over time are associated with increased mortality. In contrast, randomized controlled trials suggest cardiovascular benefits with antihypertensive therapy; however, these trials are statistically underpowered (Agarwal & Sinha, 2009). Two systematic reviews and meta-analyses have demonstrated that antihypertensive therapy and a reduction in systolic blood pressure are associated with a reduction in cardiovascular events, all-cause mortality, and cardiovascular mortality (Agarwal & Sinha, 2009; Heerspink et al., 2009).

TREATMENT TARGETS

A j-shaped curve exists in patients receiving dialysis such that both lower and higher blood pressures are associated with increased mortality. Patient level systolic blood pressure data from the Dialysis Outcomes and Practice Patterns Study

(DOPPS) indicates systolic blood pressures less than 130 mmHg are associated with increased mortality, potentially due to excessive blood pressure reductions during dialysis (Robinson, 2012). A target range of 130-159 mmHg systolic blood pressure has been suggested as optimal in the setting of hemodialysis (Robinson, 2012). This target is consistent with previous 2002 National Kidney Foundation Kidney Disease Outcomes Quality Initiative (NKF KDOQI)™ guidelines that recommended a pre-dialysis blood pressure of less than 140/90 mmHg and a post dialysis blood pressure of less than 130/80 mmHg. Currently the Kidney Disease Improving Global Outcomes (KDIGO) guideline does not recommend a specific blood pressure target for patients on hemodialysis. A randomized controlled trial in hypertensive patients receiving hemodialysis that compares specific blood pressure targets and their respective effects on all-cause mortality and cardiovascular events is required before evidence-based blood pressure targets can be elucidated (Jindal et al., 2006).

A study conducted by Agarwal et al. suggests that intradialytic blood pressure measurements are more accurate and better reflect ambulatory blood pressure than either pre-dialysis or post-dialysis blood pressure measurements. Specifically, they determined that the mid-week median blood pressure during dialysis provides 80% sensitivity and specificity for hypertension as defined by a 44-hour ambulatory blood pressure of greater than 135/85 mmHg (2008). The mid-week median BP is considered an excellent surrogate marker for ambulatory blood pressure values. Examining the median, mid-week, intradialytic blood pressure over several weeks is recommended in order to determine a patient's blood pressure trend. The trend could then be used to determine blood pressure management strategies in patients receiving hemodialysis.

NON-PHARMACOLOGIC MANAGEMENT OF HYPERTENSION IN HEMODIALYSIS PATIENTS

There are two main ways to reduce blood pressure in hypertensive hemodialysis patients that do not involve the use of medications. These methods are extremely effective and represent a rational first step to blood pressure reduction prior to the initiation of pharmacotherapy. They are:

1. Establish an appropriate dry weight.

This intervention is regarded as the first and most important step in achieving normotension in patients on hemodialysis (Santos & Peixoto, 2008). The Dry-Weight Reduction in Hypertensive Hemodialysis Patients (DRIP) study demonstrated that in long-term hypertensive patients on hemodialysis, reduction of post dialysis dry weight by 1 kg at 8 weeks was associated with a 6.6 mmHg reduction in systolic blood pressure when compared to the control group. Despite an increased incidence of intradialytic hypotension, there were no negative effects seen on quality of life surveys administered as part of the study. The authors concluded that decreasing dry weight is a simple, efficacious and well-tolerated intervention that improves blood pressure control in hypertensive patients receiving hemodialysis (Agarwal, Alborzi, Satyan, & Light, 2009).

2. Individualize the dialysate sodium prescription.

The amount of sodium in the dialysate should match or be lower than the patient's pre-hemodialysis serum sodium concentration. Higher dialysate sodium prescriptions may result in relative hypernatremia if the post hemodialysis sodium concentration is higher than the pre hemodialysis sodium concentration. Relative hypernatremia results in increased thirst, higher interdialytic weight gain, and increased blood pressure. Therefore, individualization of the dialysate sodium prescription has been shown to reduce thirst, significantly decrease interdialytic weight gain, and reduce systolic blood pressure in hypertensive patients (as defined by BP >150/85 mmHg) by 15.7/6.5 mmHg (Santos & Peixoto, 2008).

Should non-pharmacological management fail to produce the desired degree of blood pressure reduction, pharmacologic management should then be introduced. A combination of both non-pharmacologic and pharmacologic management strategies has an increased potential to reduce blood pressure more than either strategy alone. Combination strategies work together targeting different mechanisms of the underlying pathophysiology of hypertension to allow for maximal blood pressure lowering effects.

PHARMACOLOGIC MANAGEMENT OF HYPERTENSION IN DIALYSIS PATIENTS

Several classes of antihypertensive agents have been evaluated for efficacy and safety in the management of hypertension in patients receiving hemodialysis. Specifically, angiotensin II receptor blockers (ARBs), angiotensin-converting enzyme inhibitors (ACEIs), beta-blockers (BBs) and calcium channel blockers (CCBs) have been studied in controlled clinical trials to assess their relative blood pressure lowering effects with respect to cardiac outcomes. One meta-analysis including eight randomized controlled trials demonstrated that patients treated with antihypertensive agents—specifically ARBs, ACEIs, BBs or CCBs—had a weighted mean reduction in systolic and diastolic blood pressure of 4.5 mmHg and 2.3 mmHg respectively when compared with patients who received no antihypertensive therapy (Heerspink et al., 2009). Moreover, blood pressure lowering therapy was associated with a significant reduction in the risk of cardiovascular events (RR 0.71, 95% CI 0.55 to 0.92; p=0.009), all-cause mortality (RR 0.80, 95% CI 0.66 to 0.96; p=0.014) and cardiovascular mortality (RR 0.71, 95% CI 0.50 to 0.99; p=0.044) when compared with no antihypertensive therapy. It has been suggested that a randomized controlled trial comparing specific antihypertensive agents to one another is required to determine if one agent demonstrates superior efficacy with respect to cardiovascular outcomes in patients on hemodialysis with hypertension (Jindal et al., 2006). Practically speaking, the choice of antihypertensive agent should be individualized based on specific patient comorbidities. For example, patients who have a previous history of myocardial infarction (MI) or heart failure would preferentially be prescribed ACE inhibitors and beta-blockers. A review of each class of antihypertensive agent that has been evaluated in clinical trials is presented in Table 1.

CONCLUSION

In summary, hypertension is common in patients receiving hemodialysis. Untreated hypertension can lead to increased morbidity and mortality. The median blood pressure reading from the mid-week hemodialysis session correlates most closely with ambulatory blood pressure measurements. This value should be used to decide on an appropriate patient-specific management strategy. Both non-pharmacological and pharmacological therapies have been demonstrated to decrease blood pressure in patients on hemodialysis. Non-pharmacological methods such as reduction in dry weight and individualization of the sodium dialysate prescription represent effective means of reducing blood pressure in patients receiving dialysis. Once non-pharmacological strategies have been optimized, agents listed in Table 1 may be considered to further reduce blood pressure in hypertensive patients. The choice of antihypertensive should be individualized based on patient comorbidities.

Table 1: Antihypertensive agents for the treatment of hypertension in patients receiving hemodialysis

Class and Agent	Dose in Dialysis	Common Adverse Effects	Place in Therapy
ACE Inhibitors: Fosinopril Ramipril	 10-40 mg PO q12-24 Hours 5-10 mg PO Once Daily Dose after hemodialysis	Hyperkalemia, dizziness, headache, taste disturbance, dry cough, hypotension, rash	Preferred in patients with previous MI, heart failure, residual renal function or left ventricular hypertrophy.
ARBs: Candesartan Telmisartan	 16-32 mg PO Once Daily 20-80 mg PO Once Daily No dose adjustment required in hemodialysis	Hyperkalemia, dizziness, headache, hypotension	Preferred in patients with heart failure, left ventricular hypertrophy or those unable to tolerate an ACE inhibitor due to dry cough.
Beta-blockers: Carvedilol	 6.25-25 mg PO q 12-24 Hours No dose adjustment required in hemodialysis	Vivid dreams, insomnia, bradycardia, fatigue, cold extremities, reduced exercise tolerance	Preferred in patients with previous MI or heart failure. Provides the greatest blood pressure lowering effects.
Calcium Channel Blockers: Amlodipine	 2.5-10 mg PO Once Daily Does not require supplemental dosing after dialysis	Dizziness, headache, flushing, palpitations, peripheral edema	Preferred in patients with left ventricular hypertrophy or diastolic dysfunction.

REFERENCES

Agarwal, R. (2003). Systolic hypertension in hemodialysis patients. *Seminars in Dialysis*, *16*(3), 208-213.

Agarwal, R. (2010). Blood pressure and mortality among hemodialysis patients. *Hypertension*, 55, 762-768.

Agarwal, R., Sinha, A.D. (2009). Cardiovascular protection with antihypertensive drugs in dialysis patients. A systematic review and meta-analysis. *Hypertension*, 53, 860-866.

Agarwal, R., Metiku, T., Tegegne, G.G., Light, R.P., Bunaye, Z., Bekele, DM., et al. (2008). Diagnosing hypertension by intradialytic blood pressure recordings. *Clinical Journal of the American Society of Nephrology*, 3, 1364-1372.

Agarwal, R., Alborzi, P., Satyan, S., Light, R.P. (2009). Dry-weight reduction in hypertensive hemodialysis patients (DRIP): A randomized, controlled trial. *Hypertension*, 53, 500-507.

Agarwal, R. (2005). Hypertension in chronic kidney disease and dialysis: Pathophysiology and management. *Cardiology Clinics*, 23, 237-248.

Agarwal, R. (2006). Management of hypertension in hemodialysis patients. *Hemodialysis International*, 10, 241-248.

Aronoff, G.R., Bennett, W.M., Berns, J.S., Brier, M.E., Kasbekar, N., Mueller, B.A., et al. (2007). *Drug Prescribing in Renal Failure: Dosing Guidelines for Adults and Children, 5th Edition*, Philadelphia, PA: American College of Physicians.

Canadian Pharmacists Association (2011). ACE Inhibitors: CPhA Monograph. In *Electronic Compendium of Pharmaceuticals and Specialties*. Retrieved from https://www.e-therapeutics.ca

Canadian Pharmacists Association (2014). Beta-adrenergic Blocking Agents: CPhA Monograph. In *Electronic Compendium of Pharmaceuticals and Specialties*. Retrieved from https://www.e-therapeutics.ca

Canadian Pharmacists Association (2011). Calcium Channel Blockers: CPhA Monograph. In *Electronic Compendium of Pharmaceuticals and Specialties*. Retrieved from https://www.e-therapeutics.ca

Foley, R.N., & Agarwal, R. (2007). Hypertension is harmful to dialysis patients and should be controlled. *Seminars in Dialysis*, 1-4.

Heerspink, H.J.L, Ninomiya, T., Zoungas, S., de Seeuw, D., Grobbee, D.E., Jardine, M.J., et al. (2009). Effect of lowering blood pressure on cardiovascular events and mortality in patients on dialysis: A systematic review and meta-analysis of randomized controlled trials. *Lancet*, 373, 1009-1015.

Jindal, K., Chan, C.T., Deziel, C., Hirsch, D., Soroka, S.D., Tonelli, M. (2006). Management of blood pressure in hemodialysis patients. *Journal of the American Society of Nephrology*, 17, S1-S27.

Robinson, B.M., Tong, L., Zhang, J., Wolfe, R.A., Goodkin, D.A., Greenwood, R.N., ... & Port, F.K. (2012). Blood pressure levels and mortality risk among hemodialysis patients in the Dialysis Outcomes and Practice Patterns Study. *Kidney International* 82, 570–580. doi:10.1038/ki.2012.136

Salem, M.M. (1995). Hypertension in the hemodialysis population: A survey of 649 patients. *American Journal of Kidney Diseases*, *26*(5): 461-468.

Santos, S.F.F., & Peixoto, A.J. (2008). Revisiting the dialysate sodium prescription as a tool for better blood pressure and interdialytic weight gain management in hemodialysis patients. *Clinical Journal of the American Society of Nephrology*, *3*(2), 522-530.

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

Blood pressure management in patients on hemodialysis

By Stephanie Lynch and Marisa Battistella

1. Approximately what proportion of patients receiving hemodialysis has hypertension?
   a) a) 10-30%
   b) b) 50-90%
   c) c) 50-80%
   d) d) 60-90%

2. Which of the following mechanisms cause hypertension in patients receiving hemodialysis?
   a) Activation of the sympathetic nervous system
   b) Activation of the RAAS system
   c) Reduction in sodium secretion by the kidneys resulting in fluid and sodium retention
   d) All of the above

3. Which blood pressure value should be targeted in patients receiving hemodialysis?
   a) The pre-dialysis blood pressure
   b) The post-dialysis blood pressure
   c) The median mid-week intradialytic blood pressure
   d) The mean mid-week intradialytic blood pressure

4. What is the current blood pressure target recommended by KDIGO for patients with hypertension on hemodialysis?
   a) Pre dialysis blood pressure of less than 140/90 mmHg
   b) Post dialysis blood pressure of less than 130/80 mmHg
   c) Median mid-week intradialytic blood pressure of less than 140/90 mmHg
   d) No specific target is recommended by KDIGO

5. Individualization of the dialysate sodium prescription means to:
   a) Match the pre-dialysis sodium concentration to the amount of sodium present in the dialysate
   b) Match the post-dialysis sodium concentration to the amount of sodium present in the dialysate
   c) Give a standard dialysate sodium prescription to all patients regardless of the pre-dialysis sodium concentration
   d) Give a higher dialysate sodium prescription than the patient's pre-dialysis sodium concentration

6. Despite non-pharmacological management, your patient's blood pressure remains unacceptably high at 165/95 mmHg. Which of the following strategies would be the most appropriate next step?
   a) Change from an individualized to a standardized dialysate sodium prescription
   b) Increase the target weight
   c) Introduce pharmacological management while continuing with non-pharmacological management
   d) Discontinue non-pharmacological management and start combination pharmacological management using two antihypertensive agents

7. Which classes of antihypertensive agents have been studied in randomized trials examining patients with hypertension on hemodialysis?
   a) ACE inhibitors
   b) Beta-blockers
   c) Calcium channel blockers
   d) All of the above

8. Which class of antihypertensive is associated with the greatest blood pressure lowering effect?
   a) Angiotensin receptor blockers
   b) ACE inhibitors
   c) Beta-blockers
   d) Calcium channel blockers

9. Beta-blockers are associated with which cluster of adverse effects?
   a) Hyperkalemia, dry cough, dizziness
   b) Vivid dreams, insomnia, cold extremities
   c) Hyperkalemia, headache, dizziness
   d) Peripheral edema, headache, dizziness

10. Which class of antihypertensive is not recommended for both the treatment of hypertension and the management of heart failure?
    a) Angiotensin receptor blockers
    b) ACE inhibitors
    c) Beta-blockers
    d) Calcium channel blockers

CONTINUING EDUCATION STUDY ANSWER FORM

CE: 2.0 HRS CONTINUING EDUCATION

Blood pressure management in patients on hemodialysis

By Stephanie Lynch and Marisa Battistella

Volume 24, Number 3

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Opportunities and challenges caring for young adults on hemodialysis awaiting transplant

By Dr. Miqdad Bohra and Dr. Marta Novak, Psychonephrology Unit, University Health Network, Toronto, ON

QUESTION

Dear Drs Bohra and Novak,

We have many young patients listed for transplant in our hemodialysis unit. From our perspective, they are not always the most "compliant" patients that we look after in our unit. Despite the fact that they have been taught about diet, medication management and the need for attendance at routine dialysis treatments, their lab reports suggest they are not following the advice of the team. I want to come out and tell them that these behaviours could negatively impact their transplant eligibility, but my co-workers tell me it sounds as if I am threatening them. This is not the message I want to deliver, so I am writing to ask for advice on how to start this conversation with them, and to let them know that I am concerned and only want good things for them.

RESPONSE

This is a very important and frequent clinical problem. In this column, we refer to adolescents and young adults as the same group of patients, since these are common issues in the longitudinal management of our young patients through important years of development.

Adolescents and young adults go through significant personal and psychological crises where establishing their autonomy takes priority over other things. Amongst this internal conflict, there is little space for the abstract reasoning and ability required to understand and acknowledge the short-term or long-term consequences of adherence to treatment regimens, especially those for chronic conditions, which then makes adherence a particular challenge in this age group. Several factors contribute to non-adherence here including developmental pressure, depression and anxiety, lack of socialization and communication skills, poor acceptance of the diagnosis, self-esteem issues, drugs and alcohol, medication factors and familial factors. Patterns of non-adherence, as a continuum, range from accidental to purposeful to a sense of "omnipotence" and "indestructibility" that often comes with adolescence (Rianthavorn and Ettenger, 2005). Teenagers themselves recognize several reasons, as reported in a qualitative study including the complexity of the medication regimen, need for attention from others (especially in those with a good home life) or forgetfulness and lack of an adequate support system (troubled personal or home life) (Bullington et al., 2007). They also often use "denial" when coping with their illness, since they have a very strong desire to "feel normal" and be accepted by their healthy peers, wanting to follow their lifestyle without restrictions.

Approaching adolescents and young adults presenting with poor adherence is not necessarily tricky. It may be helpful for this topic to be initiated by a team member who has that "special relationship" with the teen. After a good rapport and trust is already established, direct questioning of their adherence with treatment is probably the simplest way of approaching the issue. During this discussion, we suggest acknowledging the challenges with everyday management of their chronic disease, as well as expressing empathy for these difficulties the young person might face. This gesture serves to "normalize" the challenges. Then, as a next step, we should try to understand the specific, individual barriers of care in his/her life. Certainly, an understanding and awareness of the psychosocial situation of the adolescent is very useful in formulating an approach to this problem. Awareness of family circumstances, financial status, emotional difficulties, adult and peer support around their illness, and substance/alcohol use is important to know prior to questioning the individual's adherence, as this then provides a framework to the clinician upon which to develop their understanding of the non-adherence pattern.

Advancing in a non-judgmental and "independence promoting style"—while at the same time maintaining the position that treatment adherence is a non-negotiable option—is an approach that has been helpful in our clinical practice. This would involve a conversation with the patient creating an environment where the teen or young adult feels in control, and appreciates that what has happened is not only allowed, but is their responsibility; and that they are not being penalized 'and' (not 'but') at the same time appreciate that they can change (i.e., create a dynamic where there is acceptance of their behaviour, as well as requirement or expectation of change). Another approach would be to use motivational interviewing, which, combined with a dialectical approach, can bring into the discussion the patient's own reasoning for change and what factors are considered important by the teen, as being important in ensuring their adherence. Finally, it is also crucial to clarify the role of their parents in their care, as teenagers and young adults need to develop their independent self-management while often their parents have been very involved and anxious about the care of their chronically sick children. Education is critical, but the method of educating the adolescent is different from educating an adult—for example, there is some evidence that adolescents have demonstrated improved self-care after playing games focusing on health education and disease management.

REFERENCES

Bullington, P., Pawola, L., Walker, R., Valenta, A., Briars, L. & John, E., (2007). Identification of medication non-adherence factors in adolescent transplant patients: The patient's viewpoint. *Pediatric Transplantation, 11*(8), 914–921.

Rianthavorn, P., & Ettenger, R.B. (2005). Medication non-adherence in the adolescent renal transplant recipient: A clinician's viewpoint. *Pediatric Transplantation, 9*(3), 398–407.

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