



TECHNICAL/CLINICAL TOOLS

BEST PRACTICE 3: MANAGING NUTRITION AND INFLAMMATION

WHY IS THIS IMPORTANT?

Protein energy malnutrition (PEM), also referred to as protein energy wasting, together with inflammation is commonly referred to as the malnutrition and inflammation complex syndrome (MICS). MICS denotes the close tie between these two common, concurrent outcome-predicting conditions. Many factors leading to these conditions overlap, as do assessment tools and criteria for diagnosing them (e.g., serum albumin, and markers of inflammation). The best practice includes monitoring for and addressing conditions that produce inflammation or result in malnutrition.

BEST PRACTICE 3

Systematically evaluate and manage nutrition and inflammation (the malnutrition and inflammation complex).

HOW DO YOU ACHIEVE THIS BEST PRACTICE?

1. In patients at CKD 4 or CKD 5, evaluate and manage inflammation and nutrition. Involve a Registered Dietitian based on the risk for under nutrition, a low albumin or other signs of under nutrition. The dietitian can help determine if the observation is nutrition or inflammation-related or to prevent under nutrition (Medical Nutrition Therapy). This process should be shared by primary care physician and nephrologist or ownership clearly defined by the providers.
2. Clinical team gathers data to establish baseline nutritional and inflammatory state, and monitors to trigger diagnostic evaluation and intervention as indicated, including, but not limited to albumin, body mass index, evaluation of dietary intake, ferritin or subjective global assessment. The Malnutrition Inflammation Score (MIS) may also be used. Additional laboratory tests that may be considered are c-reactive protein and cytokine levels.
3. When increased inflammation, PEM or wasting becomes evident, identify the underlying cause(s).
 - a. Generate a differential diagnosis, considering endogenous and exogenous causes. (As a place to start, refer to the abbreviated differential diagnosis lists under Tools/Resources.)
 - b. Determine which items in the differential diagnosis merit further evaluation.
4. Undertake interventions and a management plan directed at the cause of the under-nutrition and/or inflammation, and serially assess to monitor response and modify the plan accordingly.
5. Dialysis catheter use increases the risk of bacterial infection and associated hospitalization and may also increase the risk of malnutrition and inflammation. (Refer to Best Practice 1 on Catheter Avoidance.)

TECHNICAL/CLINICAL BEST PRACTICE #3: TOOLS AND RESOURCES

Web-Based Tools and Resources – Nutrition/Diet Patient Education Materials

American Association of Kidney Patients	https://www.aakp.org/aakp-library/dsp_dialysisCats.cfm?cat=7
American Dietetic Association Renal Nutrition Forum	http://www.renalnutrition.org/index.php (Members only)
DaVita, Inc.	http://www.davita.com/diet-and-nutrition/
Fresenius Medical Care	https://www.ultracaredialysis.com/engine/renderpage.asp?pid=s0102
Kidney School	http://www.kidneyschool.org/m09/
National Kidney Foundation	http://www.kidney.org/atoz/atozTopic_Nutrition-Diet.cfm/
Renal Support Network	http://kidneytimes.com/recipes.php?criteria=Recipes

Printed Tools and Resources

Clinical Practice Guidelines for Nutrition in Chronic Renal Failure	National Kidney Foundation/KDOQI http://www.kidney.org/professionals/kdoqi/guidelines_updates/doqi_nut.html
Differential Diagnosis List	Abbreviated Differential Diagnosis for Under Nutrition and Malnutrition
Differential Diagnosis List	Abbreviated Differential Diagnosis for Inflammation
Inflammation Guidelines	National Kidney Foundation/KDOQI http://www.kidney.org/professionals/kdoqi/guidelines_cvd/inflammation.htm
Malnutrition Guidelines	National Guideline Clearinghouse http://www.guideline.gov/summary/summary.aspx?doc_id=11985&nbr=6169#1188
Medical Nutrition Therapy Protocols	Centers for Medicare and Medicaid Services http://www.cms.gov/MedicalNutritionTherapy/ American Dietetic Association http://www.eatright.org/Shop/Categories.aspx?id=384
Clinical Practice Guideline for Nutrition in Children with CKD: 2008 Update	National Kidney Foundation/KDOQI http://www.kidney.org/professionals/kdoqi/guidelines_updates/pdf/CPGPedNutr2008.pdf
Standards of Practice for Registered Dietitians in Nephrology Care (available to American Dietetic Association or National Kidney Foundation-Council of Renal Nutrition members only)	http://www.eatright.org/HealthProfessionals/content.aspx?id=6867

Supporting Literature: Articles

Baris A, et al. **Malnutrition-Inflammation score is a useful tool in peritoneal dialysis patients.** *Perit Dial Int.* 2006 26:705-711. <http://www.pdiconnect.com/cgi/content/abstract/26/6/705>

<p>Brommage D, et al. ADA and NKF standards of practice and standards of professional performance for registered dietitians (Generalist, Specialty and Advanced) in nephrology care. <i>J Ren Nutr.</i> 2009 19(4):345-356. http://www.jrnjournal.org/article/S1051-2276(09)00171-X/abstract</p>
<p>Carrero J, Stenvinkel P. Persistent inflammation as a catalyst for other risk factors in chronic kidney disease: A hypothesis proposal. <i>Clin J Am Soc Nephrol.</i> 2009 4:S49-S55. http://cjasn.asnjournals.org/cgi/content/abstract/4/Supplement_1/S49</p>
<p>Cohen LM, et al. Predicting six-month mortality for patients who are on maintenance hemodialysis. <i>Clin J Am Soc Nephrol.</i> 2010 5(1), 72-79. Epub. 2009 Dec 3. http://cjasn.asnjournals.org/cgi/content/abstract/CJN.03860609v1</p>
<p>Fouque D, et al. A proposed nomenclature and diagnostic criteria for protein-energy wasting in acute and chronic kidney disease. <i>Kidney Int.</i> 2008 73(4):391-398. Epub. 2007 Dec 19. http://www.ncbi.nlm.nih.gov/pubmed/18094682</p>
<p>Kalantar-Zadeh K, et al. Malnutrition-inflammation complex syndrome in dialysis patients: causes and consequences. <i>Am J Kidney Dis.</i> 2003 42(5): 864-881. http://www.nephrology.rei.edu/MICS_03.pdf</p>
<p>Kalantar-Zadeh K, et al. Association between serum ferritin and measures of inflammation, nutrition and iron in haemodialysis patients. <i>Nephrol Dial Transplant.</i> 2004 19(1):141-149. http://ndt.oxfordjournals.org/cgi/content/abstract/19/1/141</p>
<p>Kaysen GA. Biochemistry and biomarkers of inflamed patients: Why look, what to assess. <i>Clin J Am Soc Nephrol.</i> 2009 4:S56-S63. http://cjasn.asnjournals.org/cgi/content/abstract/4/Supplement_1/S56</p>
<p>Locatelli F, et al. Nutritional-inflammation status and resistance to erythropoietin therapy in haemodialysis patients. <i>Nephrol Dial Transplant.</i> 2006 21:991-998. http://ndt.oxfordjournals.org/cgi/content/full/21/4/991</p>
<p>Sigrist MK, et al. Early initiation of phosphate lowering dietary therapy in non-dialysis chronic kidney disease: A critical review. <i>J Ren Care.</i> 2009 35(Suppl 1):71-78. http://www.ncbi.nlm.nih.gov/pubmed/19222735</p>
<p>Stenvinkel P. Inflammation in end-stage renal disease: The hidden enemy. <i>Nephrology.</i> 2006 11(1):36-41 http://www.ncbi.nlm.nih.gov/pubmed/16509930</p>
<p>Steiber A, et al. Multicenter Study of the validity and reliability of subjective global assessment in the hemodialysis population. <i>J Ren Nutr.</i> 2007 17(5):336-342. http://www.jrnjournal.org/article/S1051-2276(07)00119-7/abstract</p>
<p>Tovbin D, et al. High incidence of severe twin hemodialysis catheter infections in elderly women. Possible roles of insufficient nutrition and social support. <i>Nephron.</i> 2001 89(1):26-30. http://content.karger.com/ProdukteDB/produkte.asp?Doi=46039</p>
<p>Wells C. Optimizing nutrition in patients with chronic kidney disease. <i>Nephrol Nurs J.</i> 2003 30(6):637-646. http://annanurse.org/download/reference/journal/ND2003/30637646.pdf</p>

Wingard RL, et al. **Early intervention improves mortality and hospitalization rates in incident hemodialysis patients: RightStart program.** *Clin J Am Soc Nephrol.* 2007 2:1170–1175.
<http://cjasn.asnjournals.org/cgi/content/abstract/CJN.04261206v1>

Wingard RL, et al. **The “Right” of Passage: Surviving the first year of dialysis.** *Clin J Am Soc Nephrol.* 2009 4:S114-S120. http://cjasn.asnjournals.org/cgi/content/abstract/4/Supplement_1/S114

Wolf M, et al. **Vitamin D levels and early mortality among incident hemodialysis patients.** *Kidney Int.* 2007 72:1004-1013. <http://www.ncbi.nlm.nih.gov/pubmed/17687259>

Supporting Literature: Books

Byham-Gray L, Wiesen, K (Eds). *A Clinical Guide to Nutrition Care in Kidney Disease.* Chicago, IL: American Dietetic Association, 2004. Available for purchase at: [A clinical guide to nutrition care in kidney disease. American Dietetic Association](#)

Byham-Gray L, Burrowes J, Chertow G. (Eds). *Nutrition in Kidney Disease.* New York, NY: Humana Press, 2008. Available for purchase at: [Nutrition in kidney disease. Humana Press.](#)

Goldstein-Fuchs J. **Nutrition and chronic kidney disease** in *Contemporary Nephrology Nursing Principles and Practice.* Pitman, NJ: American Nephrology Nurses Association, 371-391, 2006. Available for purchase at: [Contemporary nephrology nursing principles and practice](#)

Kopple J, Massry S. *Nutritional Management of Renal Disease,* (2nd ed). Philadelphia, PA: Lippincott, Williams, & Wilkins, 2004. Available for purchase at: [Nutritional management of renal disease, Lippincott, Williams & Wilkins](#)

National Kidney Foundation Council on Renal Nutrition. *Pocket Guide to Nutrition Assessment of the Patient with CKD,* (4th ed). New York, NY: National Kidney Foundation, 2009. Available for purchase at: [Pocket guide to nutrition assessment of the patient with CKD](#)

Wiggins KL. *Guidelines for Nutrition Care of Renal Patients,* (3rd ed). Chicago, IL: Renal Dietitians Dietetic Practice Group. American Dietetic Association, 2002. Available for purchase at: [Guidelines for nutrition care of renal patients. Renal Dietitians Dietetic Practice Group, American Dietetic Association](#)