



**Canadian Association of Nephrology Nurses and Technologists
Nephrology Nursing Standards and Practice
Recommendations**

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Table of Contents

Preface

Introduction	9
Historical Background	9
Mission	10
Philosophy/Vision	10
Context of Practice	10
Nephrology Nursing Standards	12

Direct Care

Assessment	13
Planning	13
Implementation	13
Evaluation	14
Collaboration	14

Competence	15
-------------------------	----

Evidence Based Nursing Practice	15
--	----

Leadership

Advocacy	16
Professional Leadership	16
Quality Improvement	17
Resource Awareness	17

Nephrology Nursing Practice Recommendations

Nursing Practice Recommendations Spanning the Continuum of Chronic Kidney Disease Care

Chronic Illness Management	20
Conservative Management	23
Advance Care Planning	23

Palliative Care	24
Patient Education and Self Management	28
Blood Pressure Management	31
Anemia	35
Bone and Mineral Metabolism	38
Nutrition and Diet Therapy	41
Diabetes Management	44
Cardiovascular Risk Factor Management	49

Chronic Kidney Disease Stage 1-4

Assessment Renal Function and Chronic Kidney Disease Progression	55
Modifiable Lifestyle Risk Factors	56
Patient Education & Access Planning and Creation	56

Renal Replacement Therapies

Hemodialysis

Hemodialysis Vascular Access	62
Dialysis Adequacy	65
Hemodialysis Treatment and Complications	67
Medication Management	69
Infection Control Practices	69

Peritoneal Dialysis

Peri operative Care.....	73
Post Operative Exit Site Care	73
Dialysis Adequacy	74
Peritoneal Dialysis Treatment and Complications	75
Medication Management	76
Infection Control Practices	76

Self Managed Dialysis	79
-----------------------------	----

Transplantation

Pre-Transplant Assessment 82

Post Operative Transplant (Inpatient Care) 84

Follow Up (Outpatient Care) 87

Pediatric Considerations 91

PREFACE

In August 2007, I was privileged to accept the position of Project Coordinator for revising the CANNT Nursing Standards of Practice. Like many nephrology nurses in Canada, I have the great fortune of a lengthy and varied career in nephrology nursing which began in 1982. The practice areas and opportunities in nephrology nursing are quite diverse but very intricately connected to provide expert nursing care across a complex chronic illness continuum.

Nephrology nursing is a specialized area of nursing practice focusing on needs of patients with kidney disease and their families. This specialized care requires the nephrology nurse to promote competent, safe, ethical care, and demonstrate current specialty knowledge and practice. Standards help to ensure these values are upheld.

The CANNT board of director's vision for the standards was to incorporate the existing standards in the new document, but to broaden the depth and scope of the document to more clearly articulate the magnitude of nephrology nursing practice in Canada. To this end, the CANNT nursing standards have been developed to be congruent with national and provincial standards, are broad in scope, and allow for institutional and provincial interpretation and variation. They provide a framework for nephrology nursing practice that links professional practice accountabilities, competence, research, leadership and quality. To compliment and further delineate the various practice areas in nephrology nursing, practice recommendations have been added. These recommendations address the areas of chronic illness management, conservative management, advance care planning, palliative care, patient education and self management, blood pressure management, anemia, bone and mineral metabolism, nutrition and diet therapy, diabetes management, cardiovascular risk factor management, chronic kidney disease stage 1-4, hemodialysis, peritoneal dialysis, self managed dialysis, and transplantation.

There are a great number of expert nephrology nurses across Canada who have made substantial contributions to the revised CANNT Nephrology Nursing Standards and Practice Recommendations. It is both a humbling and exhilarating experience to work with the caliber of nurses who constitute the CANNT Standards of Practice Committee, reviewers, and contributors. Please join me in thanking them all for their diligence, consistency, patience, and expert knowledge. I would also like to acknowledge the important contribution of previous working groups who have given of their time and experience to lay a foundation for us to continue to build upon.

Marsha Wood RN, BN, MN, CNeph (C)
CANNT Nursing Standards Project Leader

Introduction

Nephrology nursing is a specialized area of nursing practice focusing on needs of patients with kidney disease and their families, across the lifespan and continuum of kidney disease care. This specialized care requires the nephrology nurse to promote competent, safe, ethical care, and demonstrate current specialty knowledge and practice. Standards help to ensure these values are upheld.

Standards demonstrate to the public, government and other stakeholders that a profession is dedicated to maintaining public trust and upholding the criteria of its professional practice (Canadian Nurses Association, 2007).

The Canadian Association of Nephrology Nurses and Technologists (CANNT), as a professional specialty association, has a societal mandate to establish, maintain, evaluate, and revise standards of practice. The nephrology nursing standards are congruent with national and provincial standards, are broad in scope, and allow for institutional and provincial interpretation and variation. The nephrology nursing practice recommendations complement the standards by providing more in-depth description of the clinical skills and judgment specific to nephrology nursing practice.

The CANNT Nephrology Nursing Standards provide a framework for nephrology nursing practice, linking professional practice accountabilities, competence, research, leadership and quality.

Historical Background

In 1968, the Canadian Society of Extracorporeal Technicians (CANSECT) was formed and Letters Patent were granted by the Canadian government. From 1968 to 1974, CANSECT was comprised of members involved in the fields of heart & lung perfusion and dialysis. These two different disciplines were linked by the common concept of extracorporeal circulation. In 1975, the differences between these two groups grew to outweigh the common purpose that brought them together. The two groups separated and the dialysis membership adopted the name, Canadian Society of Perfusionists (C.S.P.). In 1977, this group became the Canadian Society of Dialysis Perfusionists (CSDP) or the Societe canadienne des perfusionistes en dialyse. The goal of the CSDP was to share and improve the quality of extracorporeal technology.

In 1984, the CSDP's name was changed to the Canadian Association of Nephrology Nurses and Technicians (CANNT) or L'Association canadienne des infirmieres en techniciens de nephrologie. In 1996 the name was altered to the Canadian Association of Nephrology Nurses and Technologists. This name change reflects not only the growth and expansion that has occurred in our specialty, but emphasizes our increasing awareness of identity – who we are and what we do. We are nurses and technologists involved in the specialized care of nephrology patients. We care for patients during the entire continuum of chronic kidney disease; during conservative management; throughout all renal replacement modalities (including dialysis and transplantation); and palliative management. We care for patients who require total care, limited care, and self care. We work in a variety of geographical locations, in hospitals, off-site facilities, satellite centres, and in community centers. We care for patients and actively include family and others in the care process.

Our name changes provide significant insight into our changed perceptions of ourselves. Our initial interest was directed solely towards the new field of extracorporeal circulation. Today, we see hemodialysis as one modality of care; one part of the whole. We have shifted our emphasis to the concept of holistic patient care, while recognizing that the different modalities are an important aspect of the total plan of care. Our membership's interests have expanded and kept pace with the changes in treatment concepts. The name changes reflect our evolving identity and are a constant reminder that we must not build barriers to the creative ideas upon which our continued growth is contingent.

Mission

CANNT will provide leadership in facilitating the best possible nephrology care and practice through advocacy, education, research, and communication.

Philosophy/Vision

The Canadian Association of Nephrology Nurses and Technologists (CANNT) is a not-for-profit association of specialized nurses and technologists, organized under the laws of Canada, who share a desire to promote excellence in care for people with renal disease and their families through a comprehensive, multidisciplinary, evidence-based approach to nephrology practice.

Context of Practice

Nephrology nursing is a growing and evolving specialty in Canada. Certification in nephrology nursing (CNeph(C)) through the Canadian Nurses Association is increasing, with more than 1000 registered nurses holding this designation (CANNT, 2007). Nephrology nurses practice in all provinces and territories including urban teaching centres, rural and remote settings. In each province and territory there is a nursing regulatory body that oversees and regulates the practice of nursing.

The incidence and prevalence of chronic kidney disease in Canada have increased dramatically over the last 2 decades (Schaubel, Morrison, Desmeules, Parsons & Fenton, 1999). Over 30,000 Canadians have kidney failure requiring dialysis or transplant to stay alive (Kidney Foundation of Canada, 2007). The most common cause of chronic kidney disease is type 2 diabetes followed by renal vascular disease, primarily hypertension. At risk ethnic populations for chronic kidney disease include Aboriginal, Asian, South Asian, Pacific Island, African, Caribbean, and Hispanic (Kidney Foundation of Canada, 2007).

Nephrology nurses provide care across the life span and health continuum, including acute and chronic care to patients with kidney disease. They are involved in health promotion, illness prevention, the management of acute, chronic, and end-of-life care, and rehabilitation. They practice in diverse settings and clinical environments including, but not limited to, Stage 1-4 chronic kidney disease clinics, hemodialysis and peritoneal dialysis clinics, acute care nephrology wards, and kidney and kidney/pancreas transplant wards and clinics.

Canadian nephrology nurses function in a variety of roles including as expert staff registered nurses and registered/licensed practical nurses, advanced practice nurses, educators, researchers, leaders, and administrators. Kidney disease care relies on a multidisciplinary approach with nurses playing a pivotal role in coordinating this care. A challenge for nephrology nursing will be the ability to change and respond to the unique health care needs of a growing aging kidney disease population. Standards of practice and guidelines for care help articulate this specialty role to the public, other health care providers, and stakeholder groups that strive to improve care for patients at risk for and living with kidney disease.

Nephrology Nursing Standards

Direct Care

Assessment

The nephrology nurse provides a comprehensive health assessment for patients with kidney disease appropriate to the nephrology nursing practice setting.

The nephrology nurse demonstrates this standard by:

- assessing patient and family understanding of chronic kidney disease;
- assessing patient and family understanding of the impact of chronic kidney disease;
- assessing patient and family readiness to learn about kidney disease;
- assessing patient self care abilities, health goals, and expected outcomes;
- using appropriate evidence based tools/techniques for interviewing and collecting patient information;
- using health assessment frameworks appropriate for chronic disease management;
- assessing known risk factors associated with kidney disease;
- synthesizing data in a holistic manner to understand patient health issues and patient perception of health and goals for health; and
- completing a physical assessment pertinent to the individual with renal disease.

Planning

The nephrology nurse develops a plan of care appropriate to the level of kidney disease and individualized to the patient's needs.

The nephrology nurse demonstrates this standard by:

- collaborating with the patient and family to understand their goals and expected outcomes for health;
- collaborating and coordinating care with appropriate health care team members who can help patients and families achieve expected outcomes;
- ensuring the plan of care includes health promotion and prevention strategies to reduce and prevent illness;
- including strategies that promote independence, autonomy, and self reliance; and
- incorporating best demonstrated practice strategies and outcomes for managing chronic kidney disease along the health/illness trajectory.

Implementation

The nephrology nurse implements and coordinates the plan of care for patients with kidney disease.

The nephrology nurse demonstrates this standard by:

- educating patients and families about stages of kidney disease, treatments, and best practices;
- advocating for resources to help patients and families achieve optimal health;
- coordinating, modifying, and documenting the plan of care;
- collaborating with members of the nephrology team and community; and
- providing kidney disease care.

Evaluation

The nephrology nurse continually evaluates the care and outcomes for patients with kidney disease.

The nephrology nurse demonstrates this standard by:

- confirming with patients and families that established outcomes have been achieved;
- critically analyzing clinical outcomes against best demonstrated practice outcomes for kidney disease;
- evaluating the patient response to interventions;
- documenting outcomes of kidney disease care and achievement of patient health goals; and
- revising the plan of care to meet ongoing and changing health care needs.

Collaboration

The Nephrology nurse collaborates with the patient and all members of the health care team across the continuum of care to provide services to the kidney disease population.

The nephrology nurse demonstrates this standard by:

- providing consultative services;
- initiating necessary referrals and consults to allied health professionals and community organizations to achieve expected outcomes of the kidney disease plan of care;
- coordinating care in consultation with the patient, multidisciplinary team, other health professionals, and community organizations involved in the care of the patient with kidney disease;
- participating in committees/work groups established for the purpose of improving kidney disease care;
- sharing expert nephrology nursing knowledge with the team to promote excellence in kidney disease care; and
- providing and participating in educational initiatives aimed at increasing the knowledge, skill, and ability of the kidney disease health care team, health professionals, and community organizations involved in the care of patients with

Competence

The Nephrology nurse acquires, maintains and continues to develop knowledge, skill and judgment to provide the best care possible to patients with kidney disease.

The nephrology nurse demonstrates this standard by:

- being responsible for their own learning and professional development;
- identifying gaps in knowledge and formulating a plan to meet their learning needs;
- participating in nephrology unit/program orientation programs, professional practice committees, and peer teaching/learning opportunities;
- acquiring and maintaining Canadian Nurses Association certification in nephrology nursing, CNeph(C)
- attending conferences, workshops, and educational activities pertinent to nephrology nursing practice;
- staying current with trends and research in nephrology nursing;
- using and promoting the best evidence to provide chronic kidney disease care;
- participating in professional reflective practice;
- participating in performance review/evaluation; and
- providing education and sharing expert knowledge through mentorship and preceptor opportunities.

Evidence Based Nursing Practice

The Nephrology nurse participates in and facilitates evidence based practice and research initiatives to improve nephrology nursing practice and kidney disease care.

The nephrology nurse demonstrates this standard by:

- identifying questions and issues related to nephrology nursing practice and kidney disease care;
- identifying knowledge gaps in nephrology nursing practice and kidney disease care;
- critically appraising the validity, relevance, and applicability of research findings to address patient issues;
- considering nephrology expertise, patient preferences, other forms of care, and available resources in relation to available evidence;
- applying knowledge gained from research and best demonstrated practices to care for the patient with kidney disease;
- integrating relevant nephrology related research into nursing policies and procedures and quality care outcome initiatives;
- participating in nursing, collaborative interdisciplinary, and allied health research;
- developing research proposals in accordance with organizational research review standards and ethics; and

- disseminating research findings through abstracts, presentations, and publication.

Leadership

Advocacy

The nephrology nurse advocates for improving the care for and quality of life of patients with kidney disease.

The nephrology nurse demonstrates this standard by:

- empowering patients and families to develop realistic, achievable, patient-centered health goals, and collaborate on a plan of care including advance directives;
- collaborating with health care team members and the patient and their family to implement strategies to succeed in achieving patient-centered health goals ;
- educating other health professionals about the needs and challenges of patients with kidney disease;
- communicating with the patient, family, and members of the health care team regarding full disclosure of treatment options including the option of not having dialysis (“no dialysis”) or withdrawal of renal replacement therapy;
- providing information about and promoting advanced care directives;
- providing awareness of the availability of palliative care services;
- identifying gaps in the care of patients with kidney disease and taking actions to narrow and close these gaps;
- participating in committees, work groups, political lobbying activities, and/or other activities aimed at improving the care of patients with kidney disease ensuring information pertaining to assessment, planning, and provision of care (including anticipated outcomes) is documented and accessible to all members of the multidisciplinary team involved in the care of the patient with kidney disease; and
- following appropriate organizational policy/procedure when a substitute decision maker needs to be involved in care.

Professional Leadership

The nephrology nurse demonstrates leadership by providing, facilitating, and promoting the best possible care for patients with kidney disease.

The nephrology nurse demonstrates this standard by:

- taking initiative to improve kidney disease care;
- role-modeling professional values, beliefs, and attributes (e.g., acquiring nephrology nursing certification, promoting continuing education, and developing and achieving annual professional reflective practice goals);
- collaborating with patients and their families and the health team to provide professional practice that respects the rights of patients;

- advocating for patients, a patient-centered approach to care, a healthy workplace and the nursing profession;
- providing direction to, collaborating with, and sharing knowledge and expertise with novices, students, and unregulated health care providers;
- acting as a role model utilizing mentorship characteristics and ideally becoming a formal mentor;
- promoting best demonstrated practices;
- participating in nursing associations, committees, or interest groups;
- providing leadership through formal and informal roles (e.g., team leader, charge nurse, preceptor);
- taking action to resolve conflict; and
- developing innovative solutions to practice issues.

Quality Improvement

The Nephrology nurse facilitates improving the quality, safety, effectiveness, efficiency of, and satisfaction with kidney disease care.

The nephrology nurse demonstrates this standard by:

- participating in quality improvement teams and quality assurance activities;
- collaborating to identifying quality indicators;
- identifying opportunities to improve practice and kidney disease outcomes;
- evaluating outcomes of interventions in kidney disease programs; and
- maintaining current knowledge about kidney disease care and best demonstrated practices.

Resource Awareness

The nephrology nurse utilizes resources to provide effective and efficient kidney disease care.

The nephrology nurse demonstrates this standard by:

- making efforts to reduce duplication of services;
- implementing strategies to reduce fragmentation of care;
- participating in quality improvement initiatives;
- utilizing best demonstrated practices; and
- effective and efficient utilization of human and material resources.

**NEPHROLOGY NURSING PRACTICE RECOMMENDATIONS:
SPANNING THE CONTINUUM OF CHRONIC KIDNEY DISEASE
CARE**

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Palliative Care	24
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Blood Pressure Management	31
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Nutrition and Diet Therapy	41
Diabetes Management	44
Cardiovascular Risk Factor Management	49

Chronic Illness Management

Chronic illness presents challenges for patients, families, and health care providers. A patient's ability to follow medical advice, accommodate lifestyle changes, cope with their situation, and access resources are all factors that influence successful management of an ongoing illness (Caress, Luker, & Owens, 2001; King, Carroll, Newton & Dornan, 2002). Many patients with chronic kidney disease live with one or more chronic illnesses; diabetes, cardiac, vascular, and pulmonary diseases are among those more common (Lorig, Holman, Sobel & Laurent, 2006). Chronic illness impacts both physical and psychosocial health and well being for patients. Learning to live with and manage symptoms of chronic illness is an important strategy for patients with chronic kidney disease.

A major part of chronic illness management relies on self-management by the patient and self-management has been associated with improved outcomes (Costantini, L., 2006; Curtain, Mapes, Schatell, Burrows-Hudson, 2005). A critical part of nephrology nursing care is the provision and ongoing reinforcement of education and support for patient self care (Kallenbach, Gutch, Stoner, Corea, 2005). Nephrology nurses play an important role in empowering patients to take charge of their chronic illness, make health-related decisions, and achieve their optimal level of health.

Using the best available evidence and incorporating appropriate clinical practice guidelines, the nephrology nurse:

Assesses patient and family adaptation to chronic illness:

- coping strategies;
- ability to manage prescribed self care treatments;
- ability to manage illness;
- barriers to achieving goals; and
- support systems available.

Assists the patient and family to develop a plan to manage chronic illness:

- provides the patient and family with information about all treatment options so that they are able to participate fully in decisions about their care and make informed choices;
- explores patient goals and patient identified strategies to attain goals;
- encourages the identification and use of community resources for unmet needs;
- provides information about peer support groups and self-management workshops; and
- encourages the use of stress management and relaxation methods.

Provides information to patient and family to facilitate chronic illness management.

- empowers the patient and family by providing education about kidney disease, complications, symptoms, and treatments and their consequences;
- teaches the patient and family to recognize signs and symptoms of impending crisis;

- provides information to assist the patient and family to develop a plan for crisis prevention;
- provides information about community resources;
- provides information about relevant parts of the health care system;
- employs active listening techniques;
- demonstrates cultural sensitivity and a nonjudgmental attitude in interactions with patient and family; and
- provides an environment that fosters independence, encourages patient control, and promotes patient and family participation in care.

Collaborates with other disciplines to eliminate duplication of resources, reduce fragmentation of care, and ensure optimal resource management to meet the needs of the patient and family:

- coordinates the plan of care in collaboration with the patient, family, and other essential disciplines and community resources;
- documents and communicates the plan of care;
- evaluates the effectiveness of the plan of care with the patient;
- communicates outcomes and changes to the plan of care with other health professionals and agencies involved in fulfillment of the plan of care; and
- ensures those involved in the plan of care understand each member's role and responsibilities for achieving outcomes as outlined in plan of care.

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Conservative Management

Advance Care Planning

Advance care planning is a process that enables patients with decisional capacity to express their wishes about future health care in consultation with their health care providers, family members, and other important people in their lives (Dunbrack, 2006; Winnipeg Regional Health Authority, 2003). The process may involve discussion, knowledge sharing, and informed decision making around future and potential end-of-life treatment options and preferences. The primary goal of advance care planning is to seek consensus on care plans that reflect the values and preferences of the patient.

Using the best available evidence and incorporating appropriate clinical practice guidelines, the nephrology nurse:

Assesses readiness to participate in discussions about advance care planning and end-of life care and introduces concepts of advance care planning as early in the course of kidney disease as possible.

Promotes informed decision making regarding treatment options and care for kidney disease including, but not limited to:

- providing information and education about treatment options for kidney disease;
- assisting the patient and family to understand information they receive about treatment options for kidney disease;
- clarifying questions and concerns;
- assessing for symptoms of depression and stages of the grieving process; and
- involving appropriate health team members in discussions about advance care planning

Assesses patient and family current knowledge level, identified learning needs, and current preparations around advance care planning including, but not limited to:

- values and beliefs about death and dying;
- religious considerations;
- cultural considerations;
- living will;
- will;
- enduring power of attorney;
- resuscitation; and
- funeral arrangements.

Regularly reviews health status, treatments for kidney disease, and progress and ensures informed decision making regarding ongoing care.

Promotes and respects the patient’s autonomy regarding treatment choices and care for kidney disease, including the right to change decision regarding dialysis therapy.

Palliative Care

Palliative care is “an approach that improves the quality of life of patients and their families facing the problems associated with life-threatening illness, through the prevention and relief of suffering by means of early identification and impeccable assessment and treatment of pain and other problems, physical, psychosocial and spiritual” (World Health Organization, 2002). Palliative care should be considered early in the course of illness, in conjunction with other therapies that are intended to prolong life, and includes those investigations needed to better understand and manage distressing clinical complications (World Health Organization, 2002)

Patients with chronic kidney disease may decline renal replacement therapy, withdraw from dialysis or may approach death while still receiving renal replacement therapy. Quality of life for individuals living with kidney disease and dignity at the end of life are vital. In fulfilling these goals, nephrology nurses focus on preventing and relieving suffering through the management of symptoms that result in discomfort. Palliative care may be offered in conjunction with curative treatment and all other forms of appropriate medical treatment.

Nephrology nurses spend significant time with patients and their families over the course of their kidney disease and treatment. They are actively involved in providing education and discussions that help to promote decision making about treatment options and ongoing care for individuals with kidney disease.

Using the best available evidence and incorporating appropriate clinical practice guidelines, the nephrology nurse:

Assesses the palliative care needs of the patient and family throughout the continuum of kidney disease including, but not limited to:

- exploring understanding of illness trajectory and prognosis;
- identifying learning needs to promote informed decision making about renal replacement therapies and declining dialysis treatments;
- ensuring that the patient and family understand that a choice of “no dialysis” does not mean withdrawal of active treatment for managing symptoms or promoting quality of life;
- assessing for symptoms of depression and/or stages of the grieving process;
- exploring fears and concerns regarding kidney disease, treatments, and perceived prognosis;
- promoting advance care planning;
- assessing patient and family expectations and wishes for continuing and end of life care; and
- respecting the patient’s decisions regarding treatment options and respecting the

Develops a plan in collaboration with the patient and family that addresses individual and family priorities for care including, but not limited to:

- physical needs;
- environmental needs;
- psychosocial needs;
- spiritual needs;
- communication needs and expectations; and
- other identified needs.

Assesses the patient for signs and symptoms of discomfort including, but not limited to those related to:

- integumentary system (e.g, pruritus, edema, skin breakdown, dehydration);
- gastrointestinal system (e.g., nausea, vomiting, constipation, diarrhea);
- respiratory system (e.g., dyspnea, cough, congestion);
- neurological system (e.g., neuropathy, seizures, myoclonus, restless legs);
- cognitive system (e.g., agitation, confusion, depression, delirium); and
- other common symptoms related to kidney disease (e.g., fatigue, cramps, pain, sleep disturbance).

Implements strategies to optimize comfort and quality of life.

Initiates referral to palliative care or hospice in collaboration with the individual and /or family living with kidney disease.

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Patient Education and Self Management

Patient education is a fundamental and essential component of nursing practice that improves the health of individuals and provides necessary knowledge and skills for managing chronic illness such as kidney disease. The ultimate goal of patient education is to achieve long-lasting changes in behavior by providing knowledge, skills, and abilities that allow patients to make autonomous decisions and take ownership of their care to improve their own outcomes (Wingard, 2005; Thomas-Hawkins& Zazworsky, 2005).

Nephrology nurses assist patients across the continuum of kidney disease to develop skills and strategies to recognize and manage symptoms associated with disease, complex diet, and medication plans, as well as competencies required to self-manage peritoneal dialysis and hemodialysis.

Using the best available evidence and incorporating appropriate clinical practice guidelines the nephrology nurse:

Incorporates information from a variety of sources and completes a learning needs assessment considering:

- current knowledge level and patient identified learning needs;
- health history and laboratory values;
- readiness and ability to learn including: current health status and symptoms; effects of medications; mental status; previous knowledge and experiences; motivation, health behaviors and attitudes; and coping skills;
- maturational/developmental readiness including: life experiences, literacy, vocabulary, physical barriers, and problem-solving abilities;
- cultural, ethnic, and religious background;
- patient preferred learning style;
- socioeconomic status; and
- social support networks.

Develops and implements a learning plan in collaboration with the patient and family to meet learning needs. The plan includes, but is not limited to:

- clearly identifying the desired outcomes of the education;
- identifying the knowledge, skills, and abilities to be achieved as a result of education;
- materials appropriate to age, gender, culture, religious orientation, education, language, reading level, and any physical barriers;
- content that is appropriate and understandable;
- realistic and achievable goals;
- an interactive process;
- opportunity for feedback and clarification; and
- evaluation of learning or behavioral outcome.

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Blood Pressure Management

Hypertension is the second leading cause of kidney disease in Canada (Kidney Foundation of Canada, 2007). Controlling hypertension reduces overall risk for cardiovascular disease (KDOQI, 2004). Ideal blood pressure control is associated with decreased progression of kidney disease (KDOQI, 2004). The Canadian Hypertension Education Program (CHEP) (2007) and Registered Nurses Association of Ontario Nursing Best Practice Guidelines (2005) provide detailed evidence based guidelines for hypertension. Much of the evidence for blood pressure management comes from research carried out with the general population. The optimal blood pressure targets for patients with chronic kidney disease stage 5 receiving hemodialysis are unknown and widely accepted guidelines for other populations are difficult to relate to the dialysis population (Davenport, Cox, & Thuraisingham, 2008; Luther & Golper, 2008; Jindal et al., 2006). Therefore, these practice recommendations should not be generalized to the dialysis patient population. Nephrology nurses are instrumental in assessing, detecting, monitoring, treating, and evaluating patients for and with hypertension in Canada.

Using the best available evidence and incorporating appropriate clinical practice guidelines, the nephrology nurse:

Assesses the blood pressure of patients with kidney disease to detect and monitor for hypertension. Normal parameters include:

- adults: target blood pressure < 130/80 (Canadian Hypertension Education Program [CHEP], 2007); or
- pediatric: lower than the 90th percentile for normal values adjusted for age, gender, and height; or 130/80; or which ever is lower (National Kidney Foundation, 2004).

Assesses modifiable lifestyle risk factors for hypertension against recommended parameters, including:

- dietary sodium (reduced sodium intake < 100 mmol/day; CHEP, 2007);
- weight (Body Mass Index 18.5-24.9 kg/m²; CHEP, 2007);
- waist circumference (<102 cm men and < 88 cm women; CHEP, 2007);
- activity level (30-60 minutes moderate intensity dynamic exercise 4-7 days per week; CHEP, 2007);
- avoidance of first and secondhand smoke;
- stress (CHEP, 2007); and
- alcohol (\leq 2 standard drinks/day with less than 14/week for men and less than 9/week for women; CHEP, 2007).

Supports antihypertensive medication management by:

- assessing current medication regimens, successes, and challenges;
- assisting the patient to simplify medication regimens; and
- assessing patients with diabetes who are receiving Angiotensin Converting Enzyme

Develops a plan in collaboration with the patient to address modifiable lifestyle risk factors, including:

- encouraging self-management strategies including home blood pressure monitoring to promote greater patient understanding, responsibility, and improved outcomes;
- providing instruction on proper blood pressure measurement technique as outlined in CHEP guidelines (2007);
- referring to a registered dietitian as necessary; and
- educating patients about the potential to decrease and slow kidney disease progression and reduce risk from cardiovascular complications by achieving target blood pressure.

Supports patients in the management of hypertension. including:

- developing strategies in collaboration with patients to improve modifiable cardiovascular risk factors;
- educating patients about antihypertensive medications;
- educating patients about goals and targets for blood pressure management and benefits of achieving these goals and targets; and
- educating patients on how to identify edema or fluid retention.

Evaluates patient's ability to achieve blood pressure targets by:

- assessing blood pressure at each visit;
- reviewing medication history and regimen; and
- modifying plan of care in collaboration with the patient to achieve blood pressure targets.

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Anemia

Anemia is a common complication of kidney disease that starts in early stages of kidney disease and is associated with decreased quality of life (KDOQI, 2006). While cause and effect relationships have not been clearly defined, treating anemia and raising hemoglobin levels in patients with kidney disease has been associated with improved quality of life, improved muscle strength, and decreased need for transfusion, hospitalization, and death (Nurko, 2006). Nephrology nurses play an active role in assessing, teaching, planning, monitoring, and evaluating anemia in patients with kidney disease.

Using the best available evidence and incorporating appropriate clinical practice guidelines, the nephrology nurse:

Assesses patients with kidney disease for signs and symptoms of anemia, including:

- decreased energy and activity levels;
- decreased exercise capacity;
- increased shortness of breath;
- sleep disturbance;
- depression;
- decreased hemoglobin; and
- decreased iron stores.

Assesses patients with kidney disease for possible causes of anemia including:

- blood loss;
- iron deficiency;
- erythropoietin deficiency;
- vitamin deficiencies;
- uremia/inadequate dialysis;
- secondary hyperparathyroidism;
- inflammation/infection;
- malnutrition;
- hypothyroidism;
- lesion/malignancy; and
- heavy metal or aluminum toxicity.

Assesses current patient and knowledge level, self-management abilities, and anemia management strategies, including:

- understanding of anemia associated with kidney disease;
- understanding of treatments for anemia associated with kidney disease;
- current medication history including vitamins, iron supplements, and erythropoiesis stimulating agents; and

- patient ability to administer erythropoiesis stimulating agents.

Develops a plan in collaboration with the patient and health care team to achieve anemia targets and improve functional ability for patients with kidney disease:

- educates the patient about signs, symptoms and consequences of anemia associated with kidney disease;
- educates the patient about medication management (vitamins, iron, erythropoiesis stimulating agents) for anemia including benefits, side effects, strategies to reduce side effects, and signs and symptoms to report to health care professionals; and
- reinforces importance of adherence to anemia treatments.

Monitors and evaluates patient response to anemia therapy:

- monitors for improvement in signs and symptoms of anemia;
- monitors hemoglobin and iron stores regularly;
- assesses on an ongoing basis possible causes for inadequate response to therapy;
- assesses on an ongoing bases for possible side-effects and/or complications associated with therapy; and
- modifies plan of care in collaboration with the patient and health care team to achieve anemia targets.

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Bone and Mineral Metabolism

Disorders of mineral metabolism are common in kidney disease and associated with increased morbidity and mortality (KDIGO 2007). Common complications related to alterations in bone and mineral metabolism include renal osteodystrophy, secondary hyperparathyroidism, soft tissue calcification, and vascular calcification (NKF KDOQI, 2003). Nephrology nurses play an active role in assessing, teaching, planning, monitoring, and evaluating bone and mineral metabolism in patients with kidney disease.

Using the best available evidence and incorporating appropriate clinical practice guidelines, the nephrology nurse:

Assesses the patient with kidney disease for risk factors associated with bone and mineral metabolism disorders including:

- history of osteoporosis;
- older age;
- post-menopausal status;
- immobility;
- history of falls or fractures;
- risk of falls;
- use of glucocorticoids;
- vitamin D deficiency;
- abnormal calcium and phosphate levels;
- abnormal parathyroid hormone level;
- malnutrition and/or malabsorption;
- delayed growth (in children);
- malignancy; and
- liver disease.

Assesses patients with kidney disease for signs and symptoms of bone and mineral metabolism disorders including:

- bone and joint pain and swelling;
- tissue erosion;
- pruritis;
- eye irritation and inflammation;
- serum phosphorus level;
- serum calcium level;
- serum parathyroid hormone level;
- serum albumin levels;
- serum vitamin D levels (particularly in children); and
- aluminum levels (if applicable).

Assesses current knowledge level and patient and family identified learning needs

related to mineral metabolism and kidney disease and initiates a plan to address these needs including, but not limited to:

- complications related to disturbance of mineral metabolism (e.g., bone disease, secondary hyperparathyroidism, cardiovascular disease, soft tissue calcification);
- importance of diet, exercise, and medications to manage mineral metabolism; and
- signs and symptoms to report (e.g., pruritis, bone pain, skin lesions/lumps/bumps, eye irritation).

Assesses current treatment plan for mineral metabolism and patient self management skills, knowledge, and ability to carry out this plan including, but not limited to:

- diet;
- phosphate binders;
- vitamin D and analogs;
- calcimimetics;
- side effects (e.g, gastrointestinal upset, constipation, unpalatable);
- timing of mineral metabolism medications in relation to meals and other medications that may affect absorption or effectiveness; and
- dialysis adequacy.

Develops and initiates a plan in collaboration with the patient and family to meet learning needs and achieve desired targets and outcomes related to mineral metabolism including, but not limited to:

- referral to registered dietitian for diet counseling;
- reinforcement of diet instruction and restrictions;
- administration and monitoring of medications to control mineral metabolism;
- assisting patient in mastery of skills for self management;
- simplifying medication regimen where possible;
- referral to other health professionals as necessary (social worker; physiotherapy);
- exploration of perceived barriers to achieving mineral metabolism targets and outcomes (e.g, financial, complexity of plan; side effects); and
- evaluation of outcomes in collaboration with the patient and revises the plan of care when necessary.

Monitors and evaluates patient response to bone and mineral metabolism therapy including, but not limited to:

- monitoring for improvement in signs and symptoms related to bone and mineral metabolism disturbance;
- monitoring serum calcium, phosphorus, albumin, and parathyroid hormone levels regularly;
- assessing on an ongoing basis possible causes for inadequate response to therapy;

- assessing on an ongoing basis for possible side-effects and/or complications of therapy; and
- modifying the plan of care in collaboration with the patient and health care team to achieve mineral metabolism targets.

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Nutrition and Diet Therapy

Treatment for kidney disease with dietary intervention is one of the most important aspects of managing kidney disease. Dietary restrictions are almost always necessary to maintain metabolic homeostasis, but must be balanced as to avoid malnutrition. Many patients with kidney disease are malnourished and it is known that patients with hypoalbuminuria tend to do poorly on dialysis and have higher mortality rates (National Kidney Foundation, 2005).

Using the best available evidence and incorporating appropriate clinical practice guidelines, the nephrology nurse:

Assesses the nutritional status and barriers to achieving nutritional and dietary requirements of patients with kidney disease to determine their nutritional and resource needs including, but not limited to:

- weight, height, and BMI (adult);
- weight/height index (pediatric);
- head circumference (age 3 years and under);
- edema;
- serum urea, creatinine, albumin, phosphorus, calcium, lipid profile, glucose profile, bicarbonate, sodium, potassium, and magnesium;
- metabolic acidosis ;
- anemia ;
- current dietary habits, restrictions, food preferences, and cultural considerations;
- ability to obtain and prepare food;
- ability to chew and swallow;
- affordability;
- gastrointestinal disturbance;
- other illnesses requiring special dietary consideration;
- allergies;
- level of kidney disease;
- dialysis modality and adequacy;
- medication history;
- need for vitamin and mineral supplements; and
- knowledge deficits.

Assess current knowledge level and patient identified learning needs about nutritional requirements and dietary restrictions, initiates referral to dietitian, and implements a plan in collaboration with the patient including, but not limited to, providing education and information regarding:

- diet, nutrition, health considerations;
- reinforcement of registered dietitian's counseling and prescription;
- healthy choices and alternatives;

- blood work results as they relate to dietary therapy;
- tools and strategies to understand and manage fluid and hydration;
- need for vitamin and mineral supplements as necessary (e.g., multivitamins, folic acid, iron, sodium bicarbonate);
- phosphorus and phosphorus allowance;
- calcium and calcium requirements;
- potassium and potassium allowance;
- sodium reduction and sodium allowance;
- protein and protein requirements;
- importance and impact of protein in kidney disease and need for dietitian consult if restrictions are required;
- appropriate considerations related to level of kidney disease, dialysis modality, individual needs, and growth and development;
- avoiding herbal products that may have nephrotoxic effects;
- importance of adhering to dietary recommendations/restrictions for protein and sodium (if applicable) in an effort to delay the progression of kidney disease; and
- potential consequences of and complications related to hyperkalemia, mineral metabolism disturbances, and excessive sodium and water intake.

Monitors and evaluates patient response to nutrition and diet therapy:

- monitors for improved nutritional markers including height and weight;
- monitors albumin, serum urea, calcium, phosphorus, glucose, bicarbonate, hemoglobin, and iron stores regularly;
- assesses on an ongoing basis for possible causes for inadequate response to nutrition and diet therapy; and
- modifies plan of care in collaboration with the patient, family, dietitian and other members of the health care team to achieve nutrition and dietary targets.

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Diabetes Management

Type 2 diabetes is the leading cause of kidney disease in Canada and accounts for just over 40% of all end stage renal failure diagnoses in Canada (CIHI, 2006). The majority of these patients are over the age of 65 (CIHI, 2006). Diabetes rates in Aboriginal Canadians with end stage renal disease are up to eight times greater in males over the age of 50 and in females between 56 and 70 years (CIHI, 2006). Obesity is one of the major contributing factors to the increase in type 2 diabetes rates (Statistics Canada, 2005). There are also strong links to the rate of diabetes related end stage renal disease and socioeconomic status (CIHI, 2006).

There is evidence that early intervention can delay the progression of kidney disease and delay the onset of dialysis (Cavanaugh, 2007; Stripolli, Craig, & Craig, 2005). Nephrology nurses play a major role in assessing, monitoring, educating, and counseling patients with stages 1-4 kidney disease where interventions to delay progression of kidney disease can be implemented and evaluated. Optimal management of diabetes throughout all stages of kidney disease is important for the reduction of risk associated with cardiovascular disease. The incidence of diabetic foot ulcers leading to complications and amputations is high in the kidney disease population with diabetes and patients with diabetes receiving hemodialysis are at greatest risk (Broersma, 2004; Locking-Cusolito et al., 2004).

Using the best available evidence and incorporating appropriate clinical practice guidelines, the nephrology nurse:

Assesses patient current knowledge level and patient identified learning needs including, but not limited to:

- understanding and perception of relationship of diabetes to kidney disease;
- understanding of the importance of optimal blood glucose control and blood pressure control on delaying progression of kidney disease;
- understanding and appropriate management of diet;
- understanding the role of medications particularly Angiotensin Converting Enzyme Inhibitors /Angiotensin Receptor Blockers in delaying progression of kidney disease;
- understanding the patient role in self management to achieve optimal targets;
- understanding the risks associated with some diabetes medications at varying levels of kidney function; and
- understanding of increased risk for cardiovascular disease.

Assesses diabetes medication management

- assesses current medication history and regimens, and considers level of kidney function;
- assesses successes and challenges with medication management;
- assesses for side effects of medications;
- assists patients to simplify medication regimens where possible;

- educates patients about prescribed medications to manage diabetes, slow progression of kidney disease, and lower cardiovascular disease risk; and
- assesses patient's metformin use and advises patient of increased risk and contraindication in kidney disease. Notifies physician or appropriate health care provider if patient on metformin.

Assesses blood glucose management in patients with diabetes and CKD including:

- ability to achieve glycemic control targets (Canadian Diabetes Association Clinical Practice Guidelines Expert Committee [CDA], 2003):
 - Hgb A1C \leq 7% (every 3 months),
 - Pre-prandial plasma glucose 4-7 mmol/L,
 - 2-hour post prandial plasma glucose 4–10 mmol/L;
- self glucose monitoring patterns and recording results in a diary;
- psychological, physical, and financial barriers that may prohibit recommended self monitoring of blood glucose levels;
- availability of and current connection to community resources to help manage diabetes; and
- explores the impact of cultural practices and beliefs on adaptation to diabetes and self care practices.

Assesses modifiable lifestyle risk factors that contribute to diabetes and management

- weight (Body Mass Index 18.5-24.9 kg/m²; CHEP, 2007);
- blood pressure (\leq 130/80; CHEP, 2007);
- activity level (150 minutes of moderate-intensity aerobic exercise each week, spread over at least 3 nonconsecutive days of the week; resistance exercise 3 times per week; CDA, 2003);
- smoking cessation (CDA, 2003); and
- alcohol use (\leq 2 standard drinks/day with less than 14/week for men and less than 9/week for women; CDA, 2003).

Assesses patients with kidney disease and diabetes for foot complications and neuropathy including:

- examining feet for structural abnormalities and foot ulcers;
- completes risk assessment for complications (history of previous foot ulcers, sensation with 10-g monofilament; circulation; evidence of infection, self management behavior and knowledge);
- foot examinations should be performed annually for patients without neuropathy, every 6 months for patients with neuropathy and no deformity, and every 3 months for patients with a history of deformity and/or vascular disease, and every 1-3 months for patients with a history of ulceration (Peters & Lavery; 2001);
- provides foot care education including: importance of daily inspection, proper nail

- assess for neuropathic pain;
- coordinates referral for patients with foot ulcers to a health care professional with experience in diabetes foot care; and
- recognizes that any infection must be treated aggressively.

Identifies, promotes and provides information about screening that aids in prevention, onset and delay in progression of early nephropathy and complications including:

- best possible glycemic control and intensive diabetes management;
- screening for diabetic nephropathy using a random urine albumin to creatinine ratio (CDA, 2003);
- serum creatinine levels, creatinine clearance (CDA, 2003), and estimated glomerular filtration rate (Levin & Mendelssohn, 2006):
 - without albuminuria* – annually
 - with albuminuria* – at least every 6 months;
- use of an Angiotensin Converting Enzyme Inhibitor/Angiotensin Receptor Blocker to reduce urinary albumin excretion and prevent progression of nephropathy (CDA, 2003);
- importance of monitoring serum creatinine and potassium levels after initiation of Angiotensin Converting Enzyme Inhibitor/Angiotensin Receptor Blocker (1-2 weeks) (CDA, 2003); and
- importance of evaluating retinopathy by an experienced professional (CDA, 2003).

Develops and initiates a treatment plan, in collaboration with the patient, to manage diabetes risk factors associated with kidney disease and cardiovascular disease. The plan includes, but is not limited to:

- provides education regarding diabetes and kidney disease based on knowledge deficiencies and patient identified learning needs;
- promotes self-management as an integral strategy for achieving targets and goals;
- promotes patient goal setting for health behaviors;
- provides diet instruction and refer to dietitian as necessary;
- educates patients about goals and targets for diabetes management;
- assists patients in the mastery of self management strategies (example (blood glucose and blood pressure self monitoring, log keeping, management of high and low blood glucose levels, when to seek help); and
- utilizes/refers community based programs (cardiac rehabilitation, nutrition classes, exercise programs, etc.).

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Cardiovascular Risk Factor Management

Cardiovascular disease is the leading cause of death for patients with kidney disease. The incidence of cardiovascular disease is higher in the kidney disease population than in the general population and even higher in the kidney disease population with diabetes. The Canadian Society of Nephrology reports that treatment and control of cardiovascular disease risk factors is one of the primary interventions for the management of kidney disease (Levin & Mendelssohn; 2006)

The Canadian working group on hypercholesterolemia and other dyslipidemias (2003) provide detailed clinical practice guidelines on the management of dyslipidemia and the prevention of cardiovascular disease. There is evidence to support the use of statins and dyslipidemia targets in early stages of chronic kidney disease to reduce cardiovascular risk, (McMurray, 2005; Shurraw & Tonelli, 2007); however, there is a paucity of evidence regarding treatments to reduce cardiovascular risk in patients on dialysis and those with advanced chronic kidney disease (McMurray, 2005; Navaneethan & Shrivastava, 2004). These recommendations cannot be generalized to the dialysis population and those patients with advanced chronic kidney disease and program specific recommendations should be followed. Nephrology nurses are important partners with primary health care providers and patients to assist in the assessment, education, treatment, monitoring and evaluation of cardiovascular risk factors for patients with kidney disease.

Using the best available evidence and incorporating appropriate clinical practice guidelines, the nephrology nurse:

Assesses modifiable risk factors associated with lifestyle that contribute cardiovascular disease. Recommendations include:

- blood pressure ($\leq 130/80$; CHEP, 2007);
- weight (Body Mass Index 18.5-24.9 kg/m²; CHEP, 2007);
- activity level (30-60 minutes moderate intensity dynamic exercise 4-7 days per week; CHEP, 2007);
- avoidance of first and secondhand smoke;
- reduce stress (CHEP, 2007); and
- alcohol use (≤ 2 standard drinks/day and less than 14/week for men and less than 9/week for women; CDA, 2003).

Assesses traditional risk factors for cardiovascular disease:

- abnormal fasting lipid profile;
- diabetes; and
- completes global risk assessment such as Framingham Risk Score and stratifies patient risk (McPherson, Frohlich, Fodor, Genest, 2006)
- identifies patients at risk for metabolic syndrome

Based on *Dyslipidemia Risk Assessment (Adults)* (McPherson, Frohlich, Fodor,

Genest, 2006)

- patients assessed to have moderate risk of coronary artery disease should have a LDL-C < 3.5 mmol/L and total cholesterol:HDL-C ratio < 5;
- patients assessed to have high risk of coronary artery disease should have a LDL-C < 2.0 mmol/L and total cholesterol:HDL-C ratio < 4;

Based on *Dyslipidemia Risk Assessment* (American Society of Pediatric Nephrology)

- For adolescent LDL-C should be < 3.36 mmol/L
- and triglycerides should be < 2.26 mmol/L

Criteria used to define Metabolic Syndrome include 3 or more of the following

- abdominal obesity (waist circumference >102 cm men, > 88 cm women)
- triglyceride level \geq 1.7 mmol/L
- HDL-C level (Men < 1.0 mmol/L; Women < 1.3 mmol/L)
- fasting blood glucose level of 5.7-7.0 mmol/L
- Blood pressures >130/85 (McPherson, Frohlich, Fodor, Genest, 2006).

Assesses non-traditional cardiovascular risk factors associated with kidney disease:

- anemia;
- excess fluid volume;
- hyperhomocysteinemia; and
- hyperparathyroidism.

Assesses cardiovascular medication management

- assesses current medication history and regimens;
- assesses successes and challenges with medication management;
- assesses for side effects of medications;
- assists patients to simplify medication regimens where possible; and
- educates patients about prescribed medications to manage/lower cardiovascular disease risk.

Develops a plan, in collaboration with the patient, to address risk factors associated with cardiovascular disease including, but not limited to:

- encourages self-management strategies including home blood pressure monitoring to promote greater patient understanding and responsibility, and improve outcomes;
- provides diet instruction and refers to registered dietitian as necessary;
- promotes smoking cessation, healthy lifestyle choices, and maintaining healthy weight; and
- utilizes/refers patient to community-based programs (e.g., cardiac rehabilitation,

Provides information to patients on the management of cardiovascular disease risk factors including, but not limited to:

- educates patients about goals and targets for cardiovascular disease risk factors;
- assists patients in the development of self-management strategies (e.g., home blood pressure monitoring, diaries, logs); and
- assists patient to master skills for self management.

Monitors and evaluates patient response to interventions to reduce cardiovascular disease risk factors including, but not limited to:

- assesses on an ongoing basis possible causes and barriers to achieving targets for cardiovascular disease risk reduction;
- assesses for possible side-effects and/or complications of therapy;
- monitors for improved and/or stabilized signs and symptoms related to cardiovascular disease;
- monitors improvement in lifestyle modification behaviors to reduce cardiovascular disease risk factors; and
- modifies plan of care in collaboration with the patient and health care team to cardiovascular disease risk reduction targets.

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CHRONIC KIDNEY DISEASE STAGES 1-4

Assessment Renal Function and Chronic Kidney Disease Progression	55
Modifiable Lifestyle Risk Factors	56
Patient Education	56

CHRONIC KIDNEY DISEASE STAGES 1- 4

The numbers of patients in Canada with chronic kidney disease requiring renal replacement therapy has risen dramatically since 2004 (CIHI, 2006). This has resulted in an increased focus on predialysis care in the adult population. The goals of predialysis care are to delay progression of renal disease, to educate patients and families regarding kidney disease and options for care, and to prepare patients for renal replacement therapy (McCarley, P. & Burrows-Hudson, S., 2006; MacRae, Kiaii, & Levin, 2002). Early chronic kidney disease care can lead to effective planning and appropriate timing of dialysis start and access creation. The focus of care for pediatric patients emphasizes primary prevention, early detection, and aggressive management (Warady & Chadha, 2007). The renal replacement therapy of choice for the pediatric population is transplantation; preferably pre-emptive renal transplantation with a living donor when available (Bell & Ross, 2002; EBP Group on Renal Transplantation, 2002). It is recognized that a multidisciplinary team-based approach to chronic kidney disease care is preferable and may have advantages for patients that include a survival advantage, as well as a cost benefit to the health care system (Mendelssohn, 2005). The Canadian Society of Nephrology, believes the cornerstone of chronic kidney disease management lies in the treatment and control of blood pressure, management of cardiovascular disease risk factors, interruption of the renin- angiotensin system, glucose control, and smoking cessation (Levin & Mendelssohn, 2006). Nephrology nurses are instrumental in the coordination and delivery of this care.

Integral to this care are health promotion and disease prevention activities, particularly at chronic kidney disease stages 1 and 2. Stages 3 and 4 deal with more advanced renal disease where emphasis is place on education about renal replacement therapies, creating access and controlling metabolic abnormalities. The nephrology nurse plays an integral role in assessing, coordinating care, providing education and interventions and follow up of this patient population.

Using the best available evidence and incorporating appropriate clinical practice guidelines, the nephrology nurse:

Assessment Renal Function and Chronic Kidney Disease Progression

Assesses renal function and progression of chronic kidney disease including:

- height (at initial visit);
- weight;
- serum urea and creatinine;
- serum electrolytes;
- serum calcium, phosphorus, albumin; parathyroid hormone levels;
- albumin/ creatinine ratio 2.0-20.0 mg/mmol men and 2.8 – 28.0 mg/mmol women (CDA, 2003);
- albumin to creatinine ratio (Adult < 40 mg/mmol; Levin & Mendelssohn, 2006);
- albumin to creatinine ratio with first morning urine sample (American Society of Pediatric Nephrology; 2006);

- urine protein to creatinine ratio (Adult < 60 mg/mmol; Levin & Mendelssohn, 2006);
- total urine protein to creatinine ratio with first morning void (American Society of Pediatric nephrology; 2006); and
- estimated glomerular filtration rate.

Modifiable Lifestyle Risk Factors

Assesses modifiable risk factors associated with lifestyle that contribute to chronic kidney disease and progression of renal disease including:

- adult blood pressure should be $\leq 130/80$ (CHEP, 2007);
- pediatric blood pressure should be lower than the 90th percentile for normal values adjusted for age, gender and height or 130/80, whichever is lower (National Kidney Foundation, 2004);
- diet;
- smoking;
- alcohol use;
- exercise;
- stress;
- medication history (Avoid all possible drugs that may impair renal function such as nonsteroidal anti-inflammatory agents, aminoglycosides intravenous contrast if glomerular filtration rate < 60 ml/min/1.73m²; Levin & Mendelssohn, 2006);
- use of over counter medications, herbal remedies, natural medicines;
- if diabetic, Hgb A1C < 7 (CDA, 2003);
- sensation and skin integrity of the feet (if diabetic);
- frequency of eye care (if diabetic); and
- use Angiotensin Converting Enzyme Inhibitors/Angiotensin Receptor Blockers to reduce proteinuria.

Patient Education

Assesses patient and family knowledge level and patient identified learning needs and readiness to learn about:

- chronic kidney disease care delivery setting;
- normal kidney function;
- chronic kidney disease;
- common causes of chronic kidney disease;
- nutrition and chronic kidney disease;
- psychosocial and life style issues associated with chronic illness;
- medication management;
- hypertension;
- dyslipidemia;
- smoking cessation;
- diabetes management;

- anemia;
- mineral metabolism;
- living healthy with chronic kidney disease;
- renal replacement therapies for chronic kidney disease including transplantation and particularly pre-emptive transplantation in the pediatric population;
- management of chronic kidney disease when dialysis is declined or not appropriate;
- advance directives; and
- palliative care.

Develops and initiates a plan in collaboration with the patient and family to meet identified self-management, knowledge–deficit, and health promotion needs including:

- provides information about chronic kidney disease care delivery setting and other relevant health care service information;
- provides education about chronic kidney disease and chronic kidney disease management goals and targets;
- provides information about patient level of kidney function, risks factors, and self management strategies to deal with symptom management;
- provides education about renal replacement therapies including pre-emptive renal transplantation particularly in the pediatric population;
- provides education about access creation and coordinates consults related to access planning and creation;
- provides education about managing chronic kidney disease when dialysis is declined or inappropriate and explores patient feelings around this issue;
- provides information about advance directives and resources available for developing an advance directive;
- promotes self management abilities and strategies to promote health;
- provides instruction to enable patients to master skills for self management; and
- provides instruction, organizes programs, and/or refers patients to health promotion classes (e.g., smoking cessation, dyslipidemia, exercise, blood pressure management, stress management, symptom management technique).

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RENAL REPLACEMENT THERAPIES

Hemodialysis

Hemodialysis Vascular Access 62
Hemodialysis Adequacy 65
Hemodialysis Treatment and Complications 67
Medication Management 69
Infection Control Practices 69

Peritoneal Dialysis

Peri operative Peritoneal Catheter Insertion Assessment and Care 73
Post Operative Exit Site Care 73
Dialysis Adequacy 74
Peritoneal Dialysis Treatment and Complication Management 75
Medication Management 76
Infection Control Practices 76

Self Managed Dialysis 79

Transplantation

Pre-transplant Assessment 82
Post Operative Transplant (Inpatient Care) 84
Follow Up (Outpatient Care) 87
Pediatric Considerations 91

Hemodialysis

Hemodialysis is a common renal replacement therapy offered in hospital based units, freestanding units not in hospitals, or as a self care home modality. Prescriptions and methods for hemodialysis vary depending on the individual. Despite the technological advances and strengths in dialysis programs, the key to successful dialysis remains the ability to establish a good vascular access. The arteriovenous fistula is the gold standard for access related to its decreased complication rate (Thomas, 2005). Only when an arteriovenous fistula is not able to be created, should a synthetic graft, central venous catheter or other vascular access be considered as there is no benefit associated with other forms of vascular access. Access is closely linked to adequacy of the treatment (Thomas, 2005). Adequate dialysis decreases morbidity and mortality.

Using the best available evidence and incorporating appropriate clinical practice guidelines, the nephrology nurse:

Hemodialysis Vascular Access

Assesses patients for, and promotes arteriovenous fistula as first line long-term hemodialysis access including, but not limited to:

- providing education about the benefits of arteriovenous fistulas over other forms of vascular access;
- identifying patients for referral for arteriovenous fistulas;
- exploring concerns around arteriovenous fistula creation, clarifying misconceptions and developing a plan with the patient to address concerns;
- providing arteriovenous fistula candidates with instructions regarding protecting the chosen arteriovenous fistula limb and blood vessels from injury that may compromise creation and development of an arteriovenous fistula; and
- providing information about arteriovenous grafts and central venous catheters if an arteriovenous fistula is not an option.

Assesses the arteriovenous fistula/graft and limb after creation and prior to each dialysis to determine physical and functional readiness for use including, but not limited to:

- impaired healing of the incision site over the new arteriovenous fistula/graft;
- swelling;
- redness;
- bleeding/bruising;
- drainage;
- tenderness;
- aneurysm formation;
- skin irritation;
- maturation of arteriovenous fistula;

- direction of blood flow in new arteriovenous fistula/graft;
- vessel size;
- cyanosis of the finger tips and delayed capillary refill of the nail beds;
- numbness, tingling, pain in extremity;
- presence and quality of bruit and thrill temperature of the skin around the arteriovenous anastomosis for abnormal warmth; and
- comparative temperature of digits in both access and non-access limbs.

Monitors, records, and reports the access flow of the arteriovenous fistula/graft as per unit guidelines.

Addresses any concerns from the patient regarding arteriovenous fistula/graft access.

Develops and documents an access care and cannulation plan.

Assesses the patient for complications post insertion of a central venous catheter including, but not limited to:

- airway management and/or respiratory arrest;
- respiratory distress;
- cyanosis;
- bleeding, bruising, or swelling;
- hypotension with tachycardia;
- cardiac arrhythmia;
- catheter and dressing integrity; and
- pain.

Ensures that central venous catheter tip placement is verified after new catheter insertion, before proceeding with dialysis treatment.

Assesses the patient and central venous catheter access and exit site prior to each treatment including, but not limited to:

- patency;
- redness;
- discharge;
- swelling;
- bruising;
- bleeding;
- tenderness;
- line integrity;
- neck and facial swelling; and
- any concerns from the patient regarding central venous catheter access.

Assesses the patients' access for complications during hemodialysis treatment including, but not limited to:

Arteriovenous fistula/graft

- cannulation difficulties;
- pain;
- bleeding;
- infiltration;
- hematoma;
- blood flow rates; and
- arterial/venous pressures outside established parameters.

Central venous catheter

- pain;
- bleeding;
- blood flow rates;
- arterial/venous pressures outside established parameters;
- respiratory distress; and
- catheter integrity.

Notifies physician or appropriate health care provider regarding assessment findings that preclude or alter use of access and hemodialysis treatment plan.

Administers a thrombolytic agent ie. tissue plasminogen activator (tPA) as per unit protocol or physician/appropriate health care provider orders for treatment of central venous catheter thrombotic catheter dysfunction.

Cannulates arteriovenous fistula/graft in accordance with established unit protocol and using CANNT endorsed clinical educators network nursing recommendations for management of vascular access in hemodialysis patients (2006) Appendix A as a guideline.

Educates the patient about possible complications associated with hemodialysis vascular access including, but not limited to:

Arteriovenous fistula/graft

- infection;
- thrombosis;
- stenosis;
- bleeding;
- steal syndrome;
- failure of fistula maturation; and
- access infiltration.

Central venous catheter

- infection;
- central vein stenosis/thrombosis;
- catheter occlusion/fibrin sheath formation;
- catheter malfunction;
- bleeding;
- air or thrombo embolism;
- hemothorax/pneumothorax/cardiac tamponade; and
- vascular erosion, laceration, perforation.

The nephrology nurse provides instruction for the appropriate cleaning of the arteriovenous fistula/graft.

The nephrology nurse provides education and instruction about the care and protection of the access and access limb including, but not limited to:

- checking the thrill/pulse in access daily;
- using the access site only for dialysis;
- protecting from injury such as bumps and cuts;
- avoiding blood pressure checks, injections, and blood drawing;
- avoiding sleeping on access limb;
- avoiding tight jewelry or tight clothing is worn over access site; and
- avoiding heavy lifting.

Instructs the patient to report signs and symptoms suggestive of complications, and seek medical attention for, but not limited to:

- fever;
- chills;
- bleeding;
- drainage;
- absence of /or diminished thrill;
- swelling of access limb; and
- numbness, tingling, and or decreased motor function of the access limb.

Uses appropriate cleaning and infection control techniques when accessing any type of hemodialysis access.

Hemodialysis Adequacy

Assesses the patient on an ongoing basis for signs and symptoms of inadequate dialysis including, but not limited to:

- fatigue;
- loss of appetite;
- nausea;
- vomiting;
- pruritis;
- difficulty concentrating;
- weight loss;
- anemia;
- secondary hyperparathyroidism;
- neuropathy;
- restless legs;
- abnormal electrolytes;
- pericarditis; and
- changes in cognitive function;

Assesses possible causes for hemodialysis delivered dose parameters that are below the minimum acceptable level (i.e. urea clearance < 65% or Kt/V < 1.2) including, but not limited to:

- low pump speeds;
- inadequate dialysate flow for dialyser size;
- recirculation;
- lost dialysis time;
- arteriovenous fistula/graft stenosis;
- error in sampling procedure;
- inappropriate dialyzer size or clearance;
- inadequate dialyzer priming;
- excessive dialyzer clotting; and
- incorrect needle placement.

Develops a plan in collaboration with the patient to achieve adequate dialysis treatments including, but not limited to:

- adhering to prescribed dialysis treatment time;
- maximizing pump speeds;
- minimizing complications such as hypotension and cramps that potentially reduce dialysis time;
- appropriate needle size and placement; and
- adherence to dietary and fluid restriction.

Collects data and participates in quality assurance activities to improve hemodialysis adequacy outcomes.

Educates the patient about dialysis adequacy, the importance of receiving full dialysis treatments, possible consequences and complications related to inadequate

dialysis.

Hemodialysis Treatment and Complications

Assesses the patient's health status/health concerns between hemodialysis treatments for intercurrent illness and complications that might affect current hemodialysis treatment including, but not limited to:

- dizziness;
- weakness;
- hypotension;
- feeling unwell;
- fever;
- nausea;
- vomiting;
- diarrhea;
- chest pain;
- shortness of breath;
- new medications, changes in medication dosing, or discontinued medications;
- bleeding;
- bruising;
- falls; and
- medical/surgical treatments or procedures.

Assessment includes:

- symptom onset;
- location/radiation;
- duration;
- intensity/character; and
- aggravating and relieving factors.

Collaborates with physician or appropriate health care provider and the patient to develop and implement a plan of care to improve dialysis adequacy.

Completes a focused physical assessment of the patient before, during, and after dialysis including, but not limited to:

- weight (pre and post dialysis);
- blood pressure;
- heart rate;
- respiratory rate and quality;
- edema (peripheral, facial, sacral, periorbital);
- jugular venous distention;
- level of consciousness and orientation; and

- heart and lung sounds.

Confirms dialysis prescription and orders prior to initiating hemodialysis treatment including, but not limited to:

- dialyzer;
- electrolyte/molecular composition of dialysate;
- frequency and length of treatment;
- blood flow and dialysate flow rate;
- anticoagulation;
- dialysate temperature;
- ultrafiltration profiling;
- sodium profiling; and
- target weight.

Reviews and assesses the most recent laboratory tests prior to dialysis treatment and assesses for conflict with dialysis prescription.

Assesses hemodialysis equipment prior to dialysis initiation for:

- disinfection;
- blood pump occlusion;
- functioning alarms;
- integrity of extracorporeal circuit;
- dialysate conductivity; and
- water treatment congruent with unit policy.

Assesses the patient during the dialysis treatment to ensure that access is secure (i.e. needles and lines securely taped, access is visible).

Assess the patient during the hemodialysis treatment for complications and responds to unexpected outcomes including, but not limited to:

- hypotension;
- cramping;
- disequilibrium syndrome;
- air embolism;
- hemolysis;
- bleeding/hemorrhage /exsanguination;
- blood leak;
- clotting of circuit;
- cardiac events (e.g., dysrhythmias, angina, uremic pericarditis, cardiac arrest);
- dialyzer reaction;
- pyrogenic reaction;

- infection; and
- monitoring the hemodialysis machine and extracorporeal circuit.

Engages the patient in the hemodialysis treatment and encourage participation and self management where possible.

Collaborates with the patient to evaluate the hemodialysis treatment, set between treatment goals, and revises the plan of care as necessary for next treatment.

Assesses knowledge needs and develops and implements a plan in collaboration with the patient regarding hemodialysis therapy and associated treatments including, but not limited to:

- diet/fluid;
- anemia;
- bone and mineral metabolism;
- medications; and
- care of access.

Medication Management

Assesses medication regimen and develops a plan with the patient that includes, but is not limited to:

- current medication regimens, successes, and challenges;
- assists the patient to simplify medication regimens;
- administers prescribed medications during the hemodialysis treatment;
- identifies indications and interactions for commonly administered hemodialysis medications (e.g., erythropoiesis stimulating agents, iron preparations, vitamin D sterols, antibiotics, thrombolytic agents);
- completes and documents a medication history as per unit policy and assesses for any dosing changes, new or discontinued medications with each treatment; and
- educates the patient about medications, including timing in relation to hemodialysis schedule and assists patient to simplify medication regimen where possible.

Infection Control Practices

Follows unit-based infection control procedures for:

- cleaning and disinfection of equipment and work area between patient appointments;
- handling medications;
- handling and disposal of contaminated supplies;
- adherence to infection and prevention and control measures;
- ensures appropriate isolation techniques;
- vaccinations for influenza and pneumonia as per unit policy;

- tuberculosis if pertinent to patient population; and
- screening patients for antibiotic resistant organisms (e.g., Methicillin Resistant Staphylococcus Aureus, Vancomycin Resistant Enterococcus) as per unit policy.

Viral Infections (CDC, 2001)

- assesses patients Hep B, C and HIV status prior to initial dialysis, and longitudinally, as per unit protocols;
- vaccinates all susceptible patients against hepatitis B;
- follows unit policy for initial testing, vaccination and follow up of hepatitis B and C.

Adheres to unit policies related to prevention and transmission of blood-borne pathogens:

- ensures inspection of the internal pressure tubing set and pressure sensing port for possible blood contamination -- if contaminated, the machine is disinfected before it is used again;
- uses an external transducer protector and alarm capabilities as indicated in the manufacturer's instructions;
- assesses the external transducer protector for wetness. If this becomes wetted, it is replaced immediately and inspected. If fluid is visible on the side of the transducer protector that faces the machine, ensures qualified personnel should open the machine and check for contamination after the treatment is completed;
- ensures that if contamination has occurred, the machine is taken out of service and disinfected before further use; and
- monitors for frequent venous and arterial pressure alarms or frequent adjustment of blood drip chamber levels which may indicate that this problem is occurring.

Other Relevant Guidelines:

British Columbia Renal Agency. (2007). Assessment of newly created AV fistulas and grafts. Provincial Guidelines. Retrieved December 17, 2007 from <http://www.bcrenalagency.ca/NR/rdonlyres/AC0BB28B-00A9-41A6-BD76-55F441559B03/24745/FINALFullGuidelineMatnAssessment.pdf>

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Peritoneal Dialysis

Peritoneal dialysis is an important form of renal replacement therapy for patients with kidney failure (stage 5). It has the advantage of being a home based therapy and there is some evidence that patients receiving this type of dialysis have been more satisfied with their care than patients on hemodialysis (Juergensen, Wuerth, Finkelstein, Juergensen, Bekui, Finkelstein, 2006).

Nephrology nurses play an important role in the coordination, monitoring, counseling and education of patients receiving peritoneal dialysis. In doing so, nephrology nurses focus on the benefits and challenges associated with peritoneal dialysis, the peritoneal dialysis procedure, self management skills, associated potential complications, and health promoting behaviors.

Using the best available evidence and incorporating appropriate clinical practice guidelines, the nephrology nurse:

Pre-operatively

Assesses patient ability and supports to perform peritoneal dialysis and potential contraindications for peritoneal dialysis including, but not limited to:

- extensive abdominal adhesions that may limit ultrafiltration and dialysate flow;
- documented loss of peritoneal function;
- encapsulating peritoneal sclerosis;
- pleuro-peritoneal leak;
- irreparable hernia(s); and
- abdominal aortic aneurysm and colostomy are relative contraindications.

Assesses current knowledge level and patient identified learning needs about peritoneal dialysis, develops and implements a plan including, but not limited to:

Pre-operatively

- benefits and risks associated with peritoneal dialysis including the incidence and nature of complications;
- concerns and questions about peritoneal dialysis; and
- bowel preparation and the importance of avoiding constipation prior to and after catheter insertion.

Postoperatively

Provides exit site care and educates the patient in the postoperative care of the peritoneal dialysis catheter including, but not limited to:

- keeping operative site clean to minimize bacterial colonization of exit site and tunnel;

- covering the exit site with an absorbent dressing;
- stabilizing the catheter to minimize catheter movement and prevent trauma to the exit site and traction to the cuff(s); and
- cleaning the site as per organization approved standard cleaning protocol.

Dialysis Adequacy

Assesses the patient on an ongoing basis for signs and symptoms of inadequate dialysis including, but not limited to:

- fatigue;
- loss of appetite;
- nausea;
- vomiting;
- pruritis;
- difficulty concentrating;
- weight loss;
- anemia;
- secondary hyperparathyroidism;
- neuropathy;
- restless legs;
- edema;
- abnormal electrolytes;
- pericarditis/pericardial effusions; and
- changes in cognitive function.

Assesses adequacy of peritoneal dialysis

(a) Assesses possible causes for peritoneal dialysis delivered dose parameters that are below the minimum acceptable level (i.e. weekly Kt/V < 1.7) including, but not limited to:

- change in peritoneal membrane transport characteristics;
- membrane failure;
- loss of residual renal function;
- missed peritoneal dialysis exchanges;
- inadequate dialysis prescription; and
- sampling error.

(b) Assesses physical findings including:

- target weight;
- blood pressure;
- heart rate;
- chest pain;

- respiratory rate and quality;
- edema (peripheral, facial, sacral, periorbital); and
- cognitive function.

Assesses the suitability of the dialysis prescription based on assessment findings and recommends, in collaboration with physician or appropriate health care provider, appropriate volume and frequency of exchanges and target weight.

Collects data and participates in quality assurance activities to improve peritoneal dialysis adequacy outcomes.

Educates the patient about dialysis adequacy, the importance of receiving full dialysis treatments, and possible consequences of and complications related to inadequate dialysis.

Peritoneal Dialysis Treatment and Complications

Assesses patient for possible complications associated with peritoneal dialysis including, but not limited to:

Exit Site Infection

- exit site redness;
- drainage;
- tenderness/discomfort;
- overgrown granulation tissue; and
- swelling.

Noninfectious Peritoneal Dialysis Related Complications

- trauma to catheter tract;
- incisional hernia;
- exit site leak;
- intra-abdominal leak;
- inflow/outflow problems;
- bloody effluent;
- constipation;
- obesity; and
- hyperglycemia.

Peritonitis

- abdominal pain;
- abdominal distention;
- abdominal tenderness;

- cloudy effluent;
- fever;
- nausea;
- vomiting;
- positive culture of dialysate fluid; and
- peritoneal dialysis effluent cell count with white blood cell count >100 cells/ μ L or >50% neutrophils with or without positive cultures in addition to the above symptoms.

Assesses knowledge needs and develops and implements a plan in collaboration with the patient regarding peritoneal dialysis therapy and associated treatments including, but not limited to:

- diet/fluid;
- blood pressure control;
- anemia;
- bone and mineral metabolism; and
- medications.

Medication Management

Assesses medication regimen and develops a plan with the patient that includes, but is not limited to:

- current medication regimens, successes, and challenges;
- assists the patient to simplify medication regimens;
- identifies indications and interactions for commonly administered medications for patients receiving peritoneal dialysis (e.g., erythropoietin stimulating agents, iron supplements, phosphate binders, vitamin D sterols, vitamins, heparin, antibiotics);
- completes and documents a medication history as per unit policy and assesses for any dosing changes, and new or discontinued medications;
- instructs the patient on the proper technique for administration of intraperitoneal medications; and
- educates the patient about medications and assists the patient to simplify the medication regimen where possible.

Infection Control Practices

Assess patient knowledge level and patient identified learning needs regarding infection control recommendations associated with peritoneal dialysis and develops a plan in collaboration with the patient to address these needs.

Educates the patient about infection control recommendations including, but not limited to:

- avoiding fresh water (i.e. lakes, rivers, and streams) swimming;
- swimming in ocean or private pool as per program policy; and
- avoiding hot tubs, jacuzzis, soaking tubs, and public pools.

Follows unit based guidelines for hepatitis B surveillance and administers immunizations as ordered.

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Self Managed Dialysis

Hemodialysis and peritoneal dialysis, in their various forms, may be self managed in a limited or fully independent capacity at in-centre units, satellite clinics, self care facilities and at home.

Self management of dialysis, particularly in the home setting is associated with increased quality of life, improved psychosocial adjustment, increased employment opportunities, decreased anxiety and stressors (Harwood & Leitch, 2006).

Nephrology nurses play an integral role in the coordination, monitoring, counseling and education of patients undertaking self managed dialysis therapies. In providing instruction for self managed dialysis therapies, nephrology nurses apply principles of learning and education theory that are age and developmentally appropriate in order to provide effective programs.

Using the best available evidence and incorporating appropriate clinical practice guidelines, the nephrology nurse:

Assesses current knowledge and motivating factors for considering self care dialysis modalities.

Provides information and clarifies misconceptions about self care dialysis modalities and explores patient self care dialysis modality preference.

Explores the possible benefits and disadvantages of self care dialysis modalities including, but not limited to:

Benefits

- increased control over illness;
- increased time for daily activities;
- decreased travel time;
- increased schedule flexibility;
- increased time with family; and
- increased quality of life.

Disadvantages

- increased responsibilities;
- training time commitment;
- possible increased stressors;
- accommodation requirements during training period; and
- child care requirements during training.

Assesses patient suitability for self care dialysis including, but not limited to:

- physical stability;
- nutritional status;

- communication ability;
- ability to maintain self care;
- psychological/cognitive suitability; and
- social support and person(s) to be involved in training.

Incorporates information from a variety of sources and completes a learning needs assessment considering:

- current knowledge level and patient identified learning needs in relation to self managed dialysis;
- health history and laboratory values;
- readiness and ability to learn including: current health status and symptoms, effects of medications, mental status, previous knowledge and experiences, motivation, health behaviors and attitudes, and coping skills;
- maturational/developmental readiness including: life experiences, literacy, vocabulary, physical barriers, and problem-solving abilities;
- cultural, ethnic, and religious background;
- patient preferred learning style;
- socioeconomic status; and
- social support networks.

Develops and implements a dialysis self management learning plan in collaboration with the patient to meet identified learning needs.

The plan incorporates the learning needs assessment and also takes into consideration factors that may influence the training process and length of training completion including, but not limited to:

- the knowledge, skills, and abilities to be achieved as a result of education;
- materials appropriate to age, gender, culture, religious orientation, education, language, reading level, and any physical barriers;
- content that is appropriate and understandable;
- realistic and achievable goals;
- an interactive process;
- opportunity for feedback and clarification;
- learning or behavioral outcome;
- nurse/patient ratio; and
- dialysis modality.

The plan includes, but is not limited to:

- principles of dialysis;
- concept of dry/goal/target weight;
- dialysis prescription;
- goals of treatment;

- access management and care;
- dialysis techniques;
- dialysis schedules;
- possible complications;
- signs and symptoms to report;
- identifying problems or concerns that should be reported to the self management dialysis program;
- what to do and who to call in case of emergency;
- trouble shooting technical problems;
- record keeping;
- lifestyle adaptations;
- environment considerations for equipment and procedures;
- diet considerations;
- infection control measures;
- care and cleaning of equipment; and
- disposal of waste.

Assesses medication regimen and develops a plan with the patient that includes, but is not limited to:

- current medication regimens, successes, and challenges;
- educates patient about medication and possible considerations with dialysis treatment modality; and
- assists the patient to simplify medication regimens where possible.

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Transplantation

Transplantation is a renal replacement therapy for chronic kidney disease that, for many patients, provides improved quality of life and survival advantage over dialysis (Danovitch, 2005; Rabbat, Thorpe, Russell & Churchill, 2000). For most patients, transplantation offers a return to a healthier productive lifestyle with different dietary and fluid restrictions which patients generally find more palatable (Danovitch, 2005). Patients receiving a renal transplant require immunosuppressive medications to prevent rejection. These medications require special monitoring and are associated with some significant long-term complications. Along with immunosuppressive medications, many other new medications such as but not limited to prophylactic antivirals, antibiotics, and gastric acid inhibitors are usually prescribed requiring education and instruction.

Common complications post renal transplant include rejection, infection, malignancies, cardiovascular disease, hypertension, diabetes, dyslipidemia, anemia, mineral, and bone disorders. Cardiovascular disease is the most common cause of death in kidney transplant recipients and may be associated with traditional and non-traditional risk factors (KDIGO, 2007).

Nephrology nurses play an important role throughout the course of transplantation which incorporates assessment, the surgical procedure, and post transplant care. They are involved in the coordination, monitoring, counseling, and education of renal transplant recipients with regard to the transplant process, the associated potential complications and treatments, as well as health promoting behaviors and risk reduction.

Nephrology nurses work collaboratively with transplant coordinators and the interdisciplinary team bearing in mind the existence of Canadian transplant standards such as those developed by the Canadian Standards Association for perfusable organs for transplantation (Canadian Standards Association, 2003) and possible provincial standards that must be adhered to throughout the transplant process. The practice guidelines addressed in this document are broad in scope and not intended to replace any existing mandatory standards related to transplantation.

Using the best available evidence and incorporating appropriate clinical practice guidelines, the nephrology nurse:

Pre-Operative Follow Up

In collaboration with transplant coordinators, and the interdisciplinary nephrology/transplant team, assesses knowledge level and patient identified learning needs related to transplantation and in collaboration with the patient develops a plan to meet these learning needs which may include, but is not limited to:

- initiating referral to the transplant coordinator;
- pre transplant evaluation including the need to evaluate for infection, malignancy, cardiovascular risks, peripheral vascular disease risks, immunology risks, and the importance of vaccinations pre transplant while patient is not immunosuppressed;

- evaluation by the transplant team (e.g., surgeon, transplant nephrologist, social worker, recipient coordinator, anaesthetist);
- transplant wait list;
- living and deceased donor transplants (brain death, donation after cardiac death, extended criteria donors);
- tissue typing, lymphocyte cross match and panel reactive antibodies;
- advantage of living donation;
- graft survival outcomes (at the end of year 2000, 83.9 % of deceased donor transplants were functioning at the end of 5 years compared to 89% of living donor transplants);
- notifying the transplant program of changes in health status;
- the need to be healthy at the time of transplant and the possibility of not receiving a transplant if changes have occurred that would prevent a successful transplant outcome;
- possible dialysis pre transplant;
- transplant surgery;
- risks and benefits of transplantation;
- immunosuppression;
- post operative course, length of stay potential complications, diagnostic tests and procedures;
- long-term follow up;
- patient expectations and health goals;
- effect on lifestyle including disability benefits; and
- explores drug coverage for medications post transplant and refers to social worker as necessary.

Assesses current health promoting behaviors and health management strategies including, but not limited to:

- current health habits and activities to promote health;
- current self care management abilities and adherence to treatment plan; and
- predisposing cardiovascular risk factors (e.g., hypertension, diabetes, dyslipidemia, smoking, obesity).

Assesses for common viruses as outlined in program guidelines with particular attention to cytomegalovirus and Epstein-Barr virus status to determine risk of infection including, but not limited to:

- cytomegalovirus viral load of recipient;
- Epstein-Barr viral load of recipient; and
- cytomegalovirus status of donor.

Administers prophylactic cytomegalovirus and Epstein-Barr virus treatments as per unit protocol.

Post-Operative Follow Up (In-patient Care)

Assesses knowledge level and patient identified learning needs related to the anticipated post operative course, possible tests and procedures. Collaborates with the patient's multidisciplinary team to develop a plan to meet these needs. The plan includes, but is not limited to:

- pain management;
- blood tests to monitor graft function, immunosuppressant medication levels, and potential complications;
- biopsies;
- ultrasounds;
- scans;
- nutrition and fluid requirements;
- activity level;
- signs and symptoms to report; and
- contact number for concerns.

Assesses fluid volume status and electrolyte balance according to unit based policies and protocols including, but not limited to:

- vital signs;
- fluid intake and output;
- weight;
- skin turgor;
- mucous membranes;
- edema (peripheral, sacral, periorbital) ;
- central venous pressure monitoring;
- jugular venous distention;
- breath sounds;
- serum electrolytes;
- serum urea;
- serum creatinine; and
- complete blood count.

Implements and evaluates a plan to manage fluid and electrolyte balance as prescribed and reports deviations from established protocols and parameters to the appropriate health care provider.(May require dialysis for hyperkalemia or fluid volume overload if delayed graft function post transplant).

Assesses respiratory function to prevent post operative atelectasis and risk for

respiratory infection including, but not limited to:

- respiratory rate;
- rhythm and depth;
- cough;
- sputum;
- breath sounds;
- laboratory results;
- fever;
- pain; and
- oxygen saturation per pulse oximetry.

Facilitates deep breathing and coughing exercises and mobilization and reports deviations from established protocols and parameters.

Assesses for signs and symptoms of graft dysfunction, including rejection, and reports deviations from established protocols and parameters including, but not limited to:

- increased creatinine;
- immunosuppressive drug levels falling outside of unit based protocols or patient specific parameters;
- decreased or cessation in urine output;
- swelling or pain over the graft;
- fever; and
- elevated blood pressure.

Assesses for signs and symptoms of urinary obstruction including:

- decreased urine output;
- bladder distension;
- sense of urgency; and
- lower abdominal pain.

Maintains urinary catheter patency as per unit based protocols and reports deviations from established protocols and parameters to appropriate health care provider.

Assesses transplant operative site including, but not limited to:

- swelling;
- redness;
- drainage;
- bleeding;
- tenderness; and

- impaired healing.

Assesses surgical drains for patency and amount color and consistency of drainage. Provides wound care as per unit guidelines.

Assesses for signs and symptoms of wound complications such lymphocele, hematomas and abscess formation that may cause pressure to the transplant site resulting in reduced kidney function including, but not limited to:

- graft tenderness;
- decreased or cessation of urine output;
- elevated creatinine;
- pelvic/abdominal swelling;
- leg swelling on the same side as the graft;
- urinary incontinence; and
- drainage from wound or increased drainage from surgical drains.

Assesses for signs and symptoms of infection, including cytomegalovirus, and reports deviations from established protocols and parameters including, but not limited to:

- fever;
- chills;
- wound drainage;
- elevated white blood cell count;
- thrush/oral lesions;
- rhinorrhea;
- cough;
- dysuria;
- hematuria;
- urinary frequency;
- foul smelling urine;
- cloudy urine;
- flank pain;
- nausea and or vomiting; and
- rash.

Administers immunosuppressants and other medications as ordered. Monitors and evaluates patient response to medication therapy including, but not limited to:

- patient reported signs/symptoms;
- laboratory results of drug levels;
- serum creatinine;
- CBC; and
- liver function tests as necessary.

In preparation for discharge, assesses current patient knowledge level and self-management abilities regarding immunosuppressants and other medications. Develops a plan in collaboration with the patient and appropriate health care provider to meet these needs including, but not limited to:

- side effects;
- interactions (with other medications, foods and beverages);
- precautions;
- what to do in medication vomited or forgotten; and
- symptoms to report.

Assesses knowledge level, patient identified learning needs and self management abilities related to discharge planning in collaboration with the patient, and develops a plan in collaboration with the patient and multidisciplinary team to meet these needs including, but not limited to:

- medication management;
- wound management;
- nutritional changes;
- increased susceptibility to infection;
- increased susceptibility to severe neurological forms of West Nile virus;
- signs and symptoms of infection;
- signs and symptoms of rejection;
- signs and symptoms of mechanical complications such as urinary retention;
- activity limitations and /or lifestyle modifications; and
- discharge plan including plan for follow up.

Promotes participation in care and self management as able.

Post-Transplant Follow Up (Out-patient Care)

Assesses for signs and symptoms of acute rejection and chronic allograft nephropathy including, but not limited to:

- graft swelling and tenderness;
- increasing creatinine trend;
- immunosuppressive drug levels falling outside established protocols or patient tailored regime;
- adherence to immunosuppressant and other medication regimen;
- proteinuria;
- hematuria;
- hypertension;
- weight gain;
- edema; and

- decreased urine output.

Assesses for signs and symptoms of infection and reports deviations from established protocols and parameters including, but not limited to:

- fever;
- chills;
- wound drainage;
- elevated white blood cell count;
- elevated creatinine;
- thrush/oral lesions;
- rhinorrhea;
- cough;
- dysuria;
- hematuria;
- urinary frequency;
- foul smelling urine;
- cloudy urine;
- flank pain; and
- rash.

Common Infections:

- most common infections < 1 month post transplant include MRSA, VRE, candida, catheter infection, wound infection, clostridium difficile colitis, aspergillus and pseudomonas (Fishman, 2007);
- most common infections 1-6 months post transplant infections for patients with PCP and antiviral (CMV, HBV) prophylaxis include: polymavirus, clostridium difficile colitis, hepatitis C infection, adenovirus, influenza, Cryptococcus neformanis, mycobacterium tuberculosis (Fishman, 2007); and
- most common infections beyond 6 months post transplant include community aquired pneumonia, urinary tract infection, aspergillus, atypical molds and mucor species, nocardia and rhodococcus species. Late viral infections include: cytomegalovirus, hepatitis B and C, herpes simplex, West Nile, and polyomavirus (Fishman, 2007).

Assesses patient for signs and symptoms of malignancy including, but not limited to:

- persistent unexplained fever;
- weight loss;
- new lumps or masses; and
- skin lesions.

Assesses transplant immunosuppression and other medication management

- review prescribed medication regimen;
- assess ability to manage regimen and adherence to regimen including reasons for non adherence such as side-effects and financial difficulties;
- explore patient concerns and perceived barriers and challenges with regimen;
- assess knowledge deficits regarding immunosuppression medications; and
- assess bowel habits for potential changes in medication absorption or gastrointestinal function.

Develops a plan in collaboration with the patient and addresses knowledge deficits, concerns, and barriers around immunosuppressant medication regimen.

Assesses for common post transplant cardiovascular risk factors including, but not limited to:

Assesses for common post transplant cardiovascular risk factors including, but not limited to:

- hypertension (see Blood Pressure Management pages 32-35);
- diabetes: pre-existing or new onset (see Diabetes Management pages 45-49);
- dyslipidemia (see Cardiovascular Risk Factor Management pages 50-53);
- obesity; and
- smoking
 - assesses patient for smoking;
 - explores patient level of motivation for smoking cessation;
 - provides information about effect on health in the context of renal transplant and increased risk for cardiovascular disease; and
 - provides information about smoking cessation programs.

Assesses current knowledge level and learning needs about infection associated with renal transplantation and develops a plan to meet these learning needs including, but not limited to:

- preventive measures for infection;
- signs and symptoms of infection; and
- reporting and seeking help.

Assesses current knowledge level and patient identified learning needs about the increased risk for malignancy associated with anti-rejection medications and develops a plan in collaboration with the patient to meet these learning needs including, but not limited to:

- increased risk for some types of cancers (i.e. non-melanoma skin cancer, lymphoproliferative disorders, cancer of the kidney and urinary tract, cervical carcinoma, liver cancer);

- importance avoiding sun exposure and wearing of sun screen;
- importance of checking skin regularly to note changes in moles and pigmentation;
- importance of regular screening investigations such as: Papanicolaou smear, mammograms, prostate specific antigen screening, and colorectal screening;
- importance of reporting persistent fever, weight loss, new lumps or masses, skin lesions;
- importance of avoiding first and secondhand smoke;
- importance of immunizations (no live vaccines); and
- importance of regular follow up with transplant team, family doctor and other specialists as applicable.

Assesses for signs and symptoms of anemia using the anemia practice recommendations found on pages 36-38. In addition to these practice recommendations, assesses patients for transplant associated causes for anemia including immunosuppression and hemolytic uremic syndrome.

Assesses for risk factors as well as signs and symptoms of post transplant mineral and bone disorders including, but not limited to:

- bone or joint pain;
- pretransplant bone and mineral disorders (hyperparathyroidism, aluminum bone disease, dialysis related amyloid bone disease);
- avascular bone necrosis;
- obesity; and
- immunosuppression related bone disease.

Assesses current knowledge level and patient identified learning needs about increased risk for bone disease and treatments to reduce risk post transplant. Develops a plan in collaboration with the patient to meet these learning needs.

Educates patients about increased risk for bone disease including, but not limited to:

- the potential need for calcium supplements, vitamins, vitamin D, bisphosphonates;
- bone mineral density testing;
- weight bearing exercise;
- limiting alcohol consumption; and
- importance of not smoking.

Assesses knowledge level, patient identified learning needs, and readiness to learn of patients with progressive renal insufficiency and chronic allograft deterioration. In collaboration with the patient and interdisciplinary health care team develops a plan to meet these needs. The plan may include but, is not limited to:

- grief counseling and psychological support;
- education about mineral metabolism and progressive renal insufficiency;
- education about nutritional and fluid requirements;
- education about anemia related to progressive renal insufficiency;
- education about dialysis treatment modalities and conservative management;
- access planning;
- information about advance directives;
- information about chronic kidney disease care delivery setting and other relevant health care service information;
- collaboration with, and or referral to chronic kidney disease clinic;
- collaboration with, and or referral to dialysis program; and
- referral to transplant coordinator.

Pediatric Considerations

Within the field of kidney transplantation, pediatric recipients are a unique population. The incidence of kidney disease in children in Canada is less than that seen in the adult population (Danovitch, 2005). The pediatric transplant recipient can range in age from 1 to 18 years. Care must envelope specific transplant treatment and also be adapted for the age of the recipient. Parents are an integral part of the team. If a transplant is done when a child is very young education of the child/teen must be ongoing as the child ages. Additional support for teens and parents must be provided as the youth adapts to the self management role during development to adult maturity.

There are several crucial concepts of importance that must be considered when planning the care of the pediatric renal transplant recipient. The nephrology nurse working with the pediatric renal transplant population should incorporate the concepts in the practice recommendations previously listed.

Important concepts of pediatric renal transplant care for incorporation in the practice recommendations include but are not limited to:

- Primary diagnosis
 - Goal: pre-emptive transplant whenever possible;
 - greatly impacts planning and timing for transplantation (Danovitch, 2005);
 - corrective or constructive urological surgery may be required pre-transplant.
- Donor source
 - living donation is strongly encouraged as there is statistical evidence of improved success rates (Danovitch, 2005):
 - particularly true with younger aged children;
 - facilitates planning of transplant surgery which can be particularly important in the very small child;
 - an adult sized kidney from a relatively young adult is the best option (Magee, Bucuvalas, Fremer, Harmon, Hulbert-Shearon, Mendeloff, 2004).
- Immunology
 - infections:
 - higher risk of primary and new strain CMV, EBV and BKV infections

- higher risk of diarrheal infections;
 - high risk of other viral community acquired infections (Fonescea-Aten, Michaels, 2006).
 - vaccinations:
 - imperative all immunizations be up-to-date pre-transplant;
 - ‘live’ vaccinations cannot be administered post transplant;
 - ongoing monitoring of protection required;
 - if immunity becomes non-existent recipient must be informed regarding precautionary measures.
 - immunosuppression:
 - induction therapy is routinely used in the majority of pediatric transplants (Danovitch, 2005);
 - maintenance therapy is generally higher than that required in the adult population.
- Complications
 - surgical considerations related to transplanting an adult sized kidney into a child (Salvatierra, Millan, Concepcion, 2006):
 - vascular challenges;
 - fluid requirements.
 - medical:
 - major challenges related to fluid management continue
 - increased risk of PTLD secondary to increased need for higher requirements of immunosuppression and primary EBV infection, careful monitoring essential
- Growth and development
 - lack of growth indicates need for transplantation even if child has not reached CRF Grade V (non-responsive or unable to use growth hormone);
 - catch up growth can be seen in the young child post transplant (Fuqua, 2006; Tonshoff & Mehis, 1997).
- Psycho-social concerns
 - family
 - disruption of family unit (relocation of parent with child to be close to treatment).
 - adolescent/youth
 - high risk of graft loss during adolescence (Magee, Bucuvalas, Framer, Harmon, Hulbert-Shearon, Mendeloff, 2006) (care given must anticipate and decrease risk);
 - transition planning of transfer of care of the youth to an adult program is imperative for both pediatric and adult care teams.

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