Anatomy and Physiology

It is essential that the nurse working in nephrology has a basic understanding of the anatomy and physiology of the kidney. The kidney is responsible for filtering the blood and removing waste products of metabolism as well as playing a major role in blood pressure regulation, acid-base balance, hormonal responses, and drug metabolism.

Organ cross talk involving the kidney affects multiple systems in the acutely ill patient. It is important for the nurse to understand this feedback system to evaluate the patient's response and formulate a comprehensive plan of care.

Goals

At the completion of this chapter, the nephrology nurse in the acute care setting will be able to:

- Identify the gross anatomical components of the kidney and the function of each.
- Identify the anatomical components of the nephron and the function of each.
- State the major roles of the kidneys.
- Assess and analyze pathophysiology of kidney function.
- Discuss the major indications for renal replacement therapy.
- Integrate patient assessment and lab data with functional kidney status.

_____ has met the skills and requirements of this chapter

Date: _____ Preceptor: _____

Additional Readings

Burrows, L.M. (2006). Diseases of the kidney. In A. Molzhan (Ed.), *Contemporary nephrology nursing: Principles and practice* (2nd ed., pp. 141-149). Pitman, NJ: American Nephrology Nurses Association.

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Chmielewski, C., Holechek, M.J., Ludlow, M., Yucha, C.B., Guthrie, D., Dungan, J., & Candela, L. (2008). (2006). Renal physiology. In A. Molzham (Ed.), *Contemporary nephrology nursing: Principles and practice* (2nd ed., pp. 71-118). Pitman, NJ: American Nephrology Nurses Association.

Parker, K.P. (2006). Alternations in fluid, electrolyte, and acid-base balance. In A. Molzhan (Ed.), *Contemporary nephrology nursing: Principles and practice* (2nd ed., pp. 121-139). Pitman, NJ: American Nephrology Nurses Association.

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Shira, M. (2006). The kidney. In C. Counts (ed.), *Core curriculum for nephrology nursing* (5th ed., pp. 1-88). Pitman, NJ: American Nephrology Nurses Association.

Yaklin, K.M. (2011). Acute kidney injury: An overview of pathophysiology and treatments. *Nephrology Nursing Journal, 38*(1), 13-19, 30.

Anatomy and Physiology Skills Checklist						
The orientee is able to:						
Self-Assessment	**Topic**	**Date Introduced/ Reinforced**	**Date Met**	**Method**	**Orientation Level Achieved**	**Preceptor Initials**
	Identify the Gross Anatomical Components of the Kidney and the Function of Each					
	Number, size, location					
	Capsule					
	Cortex					
	Medulla					
	Ureters					
	Bladder					
	Urethra					
	Identify the Anatomical Components of the Nephron and the Functions of Each					
	Glomerulus					
	Tubules					
	Proximal					
	Loop of Henle					
	Distal					
	Collecting Duct					
	State the Major Roles of the Kidneys					
	Waste removal					
	Fluid/electrolyte balance					
	Acid-base balance					
	Blood pressure regulation					

Anatomy and Physiology Skills Checklist						
The orientee is able to:						
Self-Assessment	**Topic**	**Date Introduced/ Reinforced**	**Date Met**	**Method**	**Orientation Level Achieved**	**Preceptor Initials**
	Hormonal influences					
	Assess and Analyze the Pathophysiology of Kidney Function					
	Describe pressure gradients/regulation in the kidney					
	Pre-renal acute kidney injury -					
	Causes					
	• Hypotension					
	• Hypovolemia					
	• Hypoperfusion					
	• Pathophysiology					
	• Treatment					
	• Nursing Assessment					
	Intra-renal acute kidney injury					
	Causes					
	• Acute tubular necrosis					
	• Acute interstitial nephritis					
	• Glomerular disease					
	• Vascular disease					
	Pathophysiology					
	Treatment					
	Nursing assessment					

Anatomy and Physiology Skills Checklist						
The orientee is able to:						
Self-Assessment	**Topic**	**Date Introduced/ Reinforced**	**Date Met**	**Method**	**Orientation Level Achieved**	**Preceptor Initials**
	Post-renal acute kidney					
	Causes					
	• Obstruction					
	Treatment					
	Alter dialysis therapy in response to patient assessment (i.e. high output failure would necessitate less fluid removal)					
	Interpret electrolyte abnormalities and act proactively to prevent complications					
	Identify how renal impairments affect other organs such as heart, lung, liver (organ cross-talk)					
	Renin-angiotension regulation of blood pressure					
	Discuss the Major Indications for Renal Replacement Therapy					
	Oliguria 0.5 mg/kg/hour greater than 6 hours					
	Anuria greater than 12 hours					
	Elevated serum creatinine					
	Elevated BUN					
	Fluid overload					

Anatomy and Physiology Skills Checklist						
The orientee is able to:						
Self-Assessment	**Topic**	**Date Introduced/ Reinforced**	**Date Met**	**Method**	**Orientation Level Achieved**	**Preceptor Initials**
	Hyperkalemia					
	Recognize signs and symptoms of uremia					
	• Metabolic acidosis					
	• Electrolyte imbalance					
	Apply RIFLE/AKIN					
	Analyze importance of dialysis dose					
	• Calculate dose by Kt/V or URR					
	• Daily or intermittent hemodialysis vs. CRRT					
	• Assess for fluid volume status					
	Integrate Patient Assessment and Lab Data with Functional Kidney Status					
	Identify type of renal failure based on patient assessment					
	Alter therapy goals in response to patient assessment (i.e. high output failure would necessitate less fluid removal)					
	Interpret electrolyte abnormalities and act proactively to prevent complications					

Anatomy and Physiology Skills Checklist

The orientee is able to:

Self-Assessment	Topic	Date Introduced/ Reinforced	Date Met	Method	Orientation Level Achieved	Preceptor Initials
	Identify how renal impairments affect other organs such as heart, lung, liver (organ cross-talk)					
	Renin-angiotension regulation of blood pressure					

Keys

Key for Self-Assessment
0 = Have not performed and/or unfamiliar with item
1 = Performed less than 5 times or have some knowledge and need additional instruction
2 = Performed more than 5 times and/or have sufficient knowledge and feel confident to perform independently

Key for Method
CR = Chart Review
Ex = Written Exam
O = Observation
S = Simulation
V = Verbalization
RD = Return Demonstration

Key for Orientation Level Achieved
N = Novice
AB = Advanced Beginner
C = Competent
P = Proficient
E = Expert

Note: This checklist may be adapted and reproduced for the sole purpose of internal use within the purchaser's facility.

Principles

Hemodialysis is a life-saving therapy. It must be done safely, accurately, and with the adjustment of treatment parameters to treat the specific needs of each patient. The nephrology nurse must understand the basic principles of dialysis to provide safe and effective treatment for the patient. The principles of dialysis are universal and do not change from one manufacturer to another or from one company's policies to another. Techniques may vary depending on equipment and practice patterns, but the principles remain the same. A comprehensive understanding and application of those principles are essential to provide safe, effective, quality care.

Goals

Upon completion of this chapter, the nephrology nurse in the acute care setting will be able to:

- Discuss and describe the basic principles of hemodialysis.
- Demonstrate machine setup using above principles.

_____ has met the skills and requirements of this chapter.

Date: _____ Preceptor: _____

Additional Readings

King, B. (2008). Principles of hemodialysis. In C. Counts (Ed.), *Core curriculum for nephrology nursing* (5th ed., pp. 662-674). Pitman, NJ: American Nephrology Nurses Association.

Latham, C.F. (2006). Hemodialysis technology. In A. Molzahn (Ed.), *Contemporary nephrology nursing: Principles and practice* (2nd ed., pp. 531-551). Pitman, NJ: American Nephrology Nurses Association.

Principles Skills Checklist

The orientee is able to:

Self-Assessment	Topic	Date Introduced and/or Reinforced	Date Met	Method	Orientation Level Achieved	Preceptor Initials
	Discuss and Describe the Basic Principles of Hemodialysis					
	Diffusion of solute across a semi-permeable membrane					
	Osmosis of water across a semi-permeable membrane					
	Ultrafiltration					
	Osmotic pressure					
	Hydraulic pressure					
	Negative pressure					
	Solute drag/convection					
	Counter – current flow					
	Demonstrate Machine Setup Using Above Principles					

Keys

Key for Self-Assessment	Key for Method	Key for Orientation Level Achieved
0 =Have not performed and/or unfamiliar with item 1 = Performed less than 5 times or have some knowledge and need additional instruction 2 = Performed more than 5 times and/or have sufficient knowledge and feel confident to perform independently	CR = Chart Review Ex = Written Exam O = Observation S = Simulation V = Verbalization RD = Return Demonstration	N = Novice AB = Advanced Beginner C = Competent P = Proficient E = Expert

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