



PATHOPHYSIOLOGY OF ACUTE AND CHRONIC RENAL FAILURE: A REVIEW

¹Prashant Gupta*, ²Aditya Gupta and ³Shreya Singh

¹Ashok Singh Pharmacy College Maharoopur Jaunpur 222180.

²Assistant Professor Department of Pharmacology Ashok Singh Pharmacy College Maharoopur Jaunpur 222180.

³Ashok Singh Pharmacy College Maharoopur Jaunpur 222180.

***Corresponding Author: Prashant Gupta**

Ashok Singh Pharmacy College Maharoopur Jaunpur 222180.

Article Received on 01/08/2021

Article Revised on 21/08/2021

Article Accepted on 09/09/2021

ABSTRACT

In this article we discuss about concise review of the pathophysiology, risk factor, sign and symptoms, consequences, diagnosis and treatment. Acute kidney injury (AKI) is a complication of sepsis in critically ill patients, and required renal replacement therapy. Bone marrow transplantation (BMT) has common problems of acute kidney injury and long-term renal dysfunction and they are highly related to mortality. Hyperkalemia is associated with increased risk of death. Multiple myeloma light chains are also directly toxic on proximal renal tubules, renal dysfunction. Cardiorenal syndromes are classified into 5 subtypes: CRS type 1(acute CRS), CRS type 2(chronic CRS), CRS type 3(acute Reno cardiac syndrome), CRS type 4(chronic reno cardiac syndrome), CRS type 5(secondary CRS). Chronic kidney disease (CKD) is defined by the Kidney Disease Improving Global Outcomes (KDIGO) guidelines as an abnormality in kidney function or structure that is present for greater than 3 months. Chronic kidney disease has become a worldwide epidemic; kidney plays a very important role in the regulation of electrolyte and acid-base balance. Pregnancy associated risks increase along with the stage of CKD.

KEYWORDS: Hyperkalemia is associated with increased risk of death.

INTRODUCTION

Acute Kidney Injury (AKI) patients, especially those are in the Intensive Care Unit (ICU) having high risk of death compared to other ill patients.^[5] When sepsis coexists, a increased mortality rate is seen.^[5] Chronic Kidney Disease (CKD) has become globally outbreak with 14% in U.S. and 5-15% in the world.^[9] The Cardio-Renal Syndrome (CRS) includes a variety of acute or chronic conditions, where the primary organs such as the kidney or the heart.^[7] The chronic kidney disease is equivalent to diabetes, it is now considered as coronary artery disease.^[11] Greater than 50% of deaths on patients with CKD are from Cardiovascular disease (CVD).^[11] Myocardial Infarction (MI), Heart Failure (HF), Cerebrovascular Accidents (CVA), Peripheral artery disease (PAD), Thromboembolic disease are the forms of cardiovascular disease (CVD). Within the therapeutic approach of "intensive metabolic support", in which both intensive insulin therapy and early combined enteral and parenteral nutrition are necessary.^[1]

Etiology (Causes)

Hyperkalemia: In response to stimuli hyperkalemia occurs in: Glomerular Filtration Rate (GFR), Tubular flow rate, Delivery of sodium to nephron, Expression of sodium-potassium channels in the apical cell membranes, PH of urinary.^[2]

Multiple Myeloma (MM): The most common etiology of renal failure in MM is hypercalcemia.^[3] Hypercalcemia interferes with renal function and impairs its ability, causes Vasoconstriction of renal Vasculature and boost secretion of urine, which may result in hypovolemia and pre-renal azotemia.^[3]

Bone Marrow Transplantation (BMT): 20% of survivors get affected by the radiation or BMT nephropathy which is a cause of late-onset renal dysfunction. Radiation kills dividing cells and damage bacteria and DNA.^[4] High-Dose of chemotherapy may result in side effect such as Nausea, Vomiting, Diarrhea, Mucositis & Hepatic Venous occlusive disease.^[4]

Cirrhosis: Based on etiology renal failure in cirrhosis is divided into: Pre-renal, Renal, Post-renal.^[6]

Pre-Renal: Vomiting

Diarrhea

Excessive secretion of urine

Hemorrhage (outflow)

Renal: Acute Tubular Necrosis (ATN)

IgA nephropathy

Glomerulonephritis

Post-Renal: Benign prostatic hyperplasia

Neurogenic bladder

Nephrolithiasis

Atheroembolic Renal Diseases: It occurs when atheromatous aortic plaques rupture and in small renal arteries releasing of cholesterol crystals.^[8]

Sign and Symptoms

Hyperkalemia: It includes male sex, lower Body Mass Index (BMI), smoking, diabetes mellitus, cerebrovascular accidents.^[2]

Multiple Myeloma: It includes loss of water in body, high level of calcium in blood, too much acid in body.^[3]

Bone Marrow Transplantation: It includes swelling of lower leg and hand, weight gain, hepatomegaly, upper right quarter of abdomen, ascites prior to AKI.^[4]

Atheroembolic Renal Disease: It includes male sex, older than age 60years, white people, high blood pressure, using of tobacco, diabetes mellitus, fever, weight loss.^[8]

Heart Failure with Kidney Disease: Traditional risk factor: age, male sex, high blood pressure, smoking, weight gain, diabetes mellitus.^[11] Novel risk factor: volume overload, loss of iron in body, swelling, mineral metabolism, under nourishment, imbalance between free radical and anti-oxidants in body.^[11]

Complications

Some major complications of Actual Renal Failure are: oedema, chest pain, weakness of muscle, kidney damage and death can occur.

Some major complications of Chronic Renal Disease are: osteoporosis, weakness of bones, loss of iron in body, pregnancy, damaged CNS, personality change, reduce immunity and inflammation of pericardium (pericarditis).

Diagnosis

Heart failure patients with kidney diseases: Heart failure (HF) is a clinical diagnosis which includes physical examination of cardiac output and other tests includes lab tests such as ECG (Electrocardiogram), chest radiographs.

Chronic kidney diseases and pregnancy: It is important to recognize type of renal diseases before pregnancy. The diagnosis includes kidney biopsy, emotional support, regular checkup blood pressure (B.P.).^[10]

Atheroembolic Renal Diseases: Renal biopsy is the best method for diagnosis. Sample from skin lesions, feet and lower legs are the best site for biopsy.^[8]

Cirrhosis: Hepatorenal syndrome diagnosis include absence of shock, low level of serum creatinine, absence of parenchymal.^[6]

Treatment

Heart failure patients with kidney diseases: HF rEF therapies, like beta-blockers and renin-angiotensin aldosterone system (RAAS) inhibitors. Beta blockers use was significantly associated with a 31% reduction in a risk of HF.^[11]

Hyperkalemia: Patiromer and ZS-9, have the potential to migrate hyperkalemia.^[9]

REFERENCES

- Gines P, Schrier RW. Renal failure in cirrhosis. *N Engl J Med.* 2009 Sep 24;361(13):1279-90. doi: 10.1056/NEJMra0809139. Erratum in: *N Engl J Med.*, 2011 Jan 27; 364(4): 389. PMID: 19776409.
- Hunter RW, Bailey MA. Hyperkalemia: pathophysiology, risk factors and consequences. *Nephrol Dial Transplant.* 2019 Dec 1; 34(Suppl 3): iii2-iii11. doi: 10.1093/ndt/gfz206. PMID: 31800080; PMCID: PMC6892421.
- Dimopoulos MA, Kastritis E, Rosinol L, Bladé J, Ludwig H. Pathogenesis and treatment of renal failure in multiple myeloma. *Leukemia.*, 2008 Aug; 22(8): 1485-93. doi: 10.1038/leu.2008.131. Epub 2008 Jun 5. PMID: 18528426.
- Kemmner S, Verbeek M, Heemann U. Renal dysfunction following bone marrow transplantation. *J Nephrol.*, 2017 Apr; 30(2): 201-209. doi: 10.1007/s40620-016-0345-y. Epub 2016 Sep 2. PMID: 27589851.
- Fani F., Regolisti G., Delsante M., Cantaluppi V., Castellano G., Gesualdo L., Villa G., Fiaccadori E. Recent advances in the pathogenetic mechanisms of sepsis-associated acute kidney injury. *J Nephrol.*, 2018 Jun; 31(3): 351-359. doi: 10.1007/s40620-017-0452-4. Epub 2017 Dec 23. PMID: 29273917.
- Mackelaite L, Alsaukas ZC, Ranganna K. Renal failure in patients with cirrhosis. *Med Clin North Am.*, 2009 Jul; 93(4): 855-69. doi: 10.1016/j.mcna.2009.03.003. PMID: 19577118.
- Ronco C, Haapio M, House AA, Anavekar N, Bellomo R. Cardiorenal syndrome. *J Am Coll Cardiol.*, 2008 Nov 4; 52(19): 1527-39. doi: 10.1016/j.jacc.2008.07.051. PMID: 19007588.
- Scolari F, Ravani P. Atheroembolic renal disease. *Lancet.*, 2010 May 8; 375(9726): 1650-60. doi: 10.1016/S0140-6736(09)62073-0. Epub 2010 Apr 8. PMID: 20381857.
- Dhondup T, Qian Q. Electrolyte and Acid-Base Disorders in Chronic Kidney Disease and End-Stage Kidney Failure. *Blood Purif.*, 2017; 43(1-3): 179-188. doi: 10.1159/000452725. Epub 2017 Jan 24. PMID: 28114143.
- Hladunewich MA. Chronic Kidney Disease and Pregnancy. *Semin Nephrol.*, 2017 Jul; 37(4): 337-346. doi:1016/j.semnephrol.2017.05.005. PMID: 28711072.
- Tuegel C, Bansal N. Heart failure in patients with kidney disease. *Heart.* 2017 Dec; 103(23): 1848-1853. doi: 1136/heartjnl-2016-310794. Epub 2017 Jul 17. PMID: 28716974.