

Prevention of Acute Renal Failure in ICU

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No Financial conflict

- ### Learning Objectives
- Identify common risk factors associated with acute kidney injury in the critical care setting
 - Discuss strategies for prevention of acute kidney injury in the ICU patient

- "If there is a urine, there is a hope" – Dr. Olivero Senior
- "Urine is like an opinion! You got to have one – Strong or weak – as any is better than none" – Dr. Hedger
- "Poor Man's Swan" – an African Anesthesiologist

"Time"

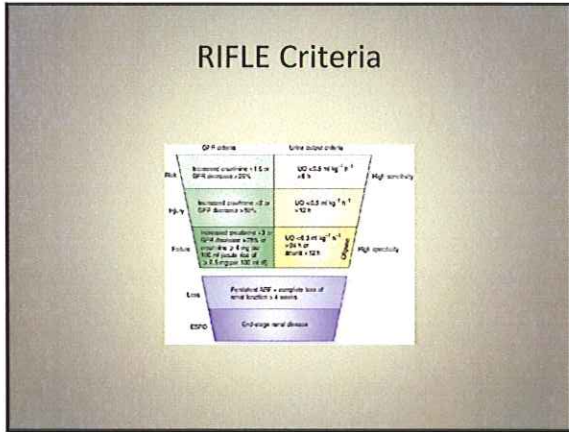
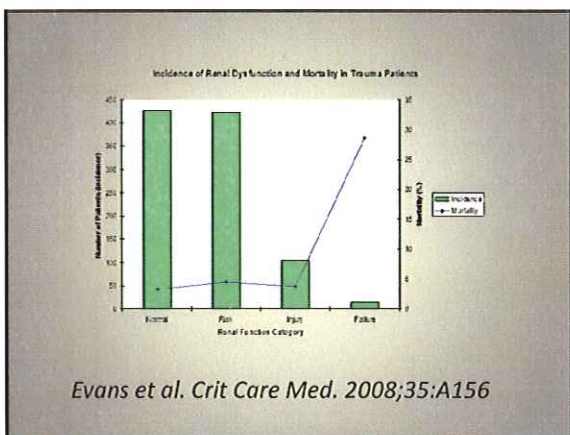
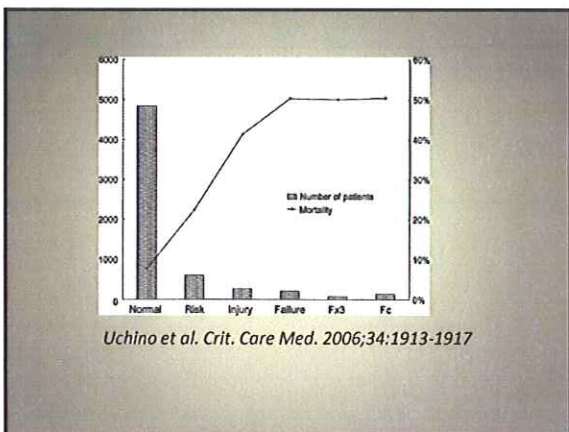


Table 2 - AKIN classification

RIFLE Classification	GFR criteria	Diuresis criteria
Stage 1	SCr increase $\times 1.5$ or $> 0.3\text{mg/dL}$	diuresis $< 0.5\text{mL/Kg/h}$ in 6h
Stage 2	SCr increase $\times 2$	diuresis $< 0.5\text{mL/Kg/h}$ in 12h
Stage 3	SCr increase $\times 3$ or SCr $> 4\text{mg/dL}$ (with acute increase $> 0.5\text{mg/dL}$)	diuresis $< 0.3\text{mL/Kg/h}$ in 24h or anuria for 12h

GFR - glomerular filtration rate; SCr - serum creatinine
 Adapted from: Mishra RI, Kafura JA, Shah SV, Molitoris RA, Ronco C, Wernick DG, Levin A: Acute Kidney Injury Network. Acute Kidney Injury Network: report of an initiative to improve outcomes in acute kidney injury. *Crit Care*. 2007;11(2):531.



BEST STUDY (JAMA 2005)

Approximately 4% of patients in the ICU receive renal replacement therapy (e.g., hemofiltration, hemodialysis).

Hospital mortality in this group is 60%.

29,629 patients
 54 centers
 23 countries

- ### Risk Factors
- Age
 - Sepsis
 - Cardiac surgery
 - Contrast
 - Diabetes
 - "Rhabdo"
 - Pre-existing Renal insufficiency
 - Hypovolemia
 - Shock

"Renal Perfusion Pressure"

"Optimum MAP"
 Is 65 a magic number?

Use of Vasopressor
 (NE is a foe or a friend?)

“Volume status”

FACTT Trial (NEJM 2006)

- Conservative arm -136 ml (10% CRRT)
- Liberal arm + 6992 (14% CRRT)

Euvoemia

Which Volume?

SAFE Trial (NEJM 2004 – 7000 patients)

- CRRT
- MV

“Colloids may be harmful”

Schortgen F, Deye N, Brochard L (2004) Preferred plasma volume expanders for critically ill patients: results of an international survey. *Intensive Care Med* 30:2222-2229

Schortgen F, Lacherade JC, Bruneel F, et al - Effects of hydroxyethylstarch and gelatin on renal function in severe sepsis: a multicentre randomised study *Lancet* 2001;357:911-6.

Cittanova MI, Leblanc J, Legendre C, Mouquet C, Riou B, Coriat P. Effect of hydroxyethylstarch in brain-dead kidney donors on renal function in kidney-transplant recipients. *Lancet* 1996; 348: 1620-1623.

Frank M, Brunkhorst, M.D., Intensive Insulin Therapy and Pentastarch Resuscitation in Severe Sepsis - *N Engl J Med* 2008; 358:125-139 January 10, 2008

Contrast Induced Nephropathy

Serum Cr 25% above baseline within 48 hours

- Barrett BJ, Parfrey PS. Clinical practice. Preventing nephropathy induced by contrast medium. *N Engl J Med* 2006;354:379-386.
- Tepel M, Aspelin P, Laméire N. Contrast-induced nephropathy: a clinical and evidence-based approach. *Circulation* 2006;113:1759-1806.

Is study really needed?

Mucomyst

1. Controversial
2. Double Dose? (Marenzi G, and Co. N-acetylcysteine and contrast-induced nephropathy in primary angioplasty. *N Engl J Med* 2006;354:2773-2782.)
3. It carries side effect
 - Hypotension
 - Bronchospasm
 - Hyponatremia
 - Seizure
 - Volume Overload

Normal Saline Vs Bicarb

- Mueller C, and Co. Incidence of contrast nephropathy in patients receiving comprehensive intravenous and oral hydration. *Swiss Med Wkly* 2005;135:286-290.
- Merten GJ, et al. Prevention of contrast-induced nephropathy with sodium bicarbonate: a randomized controlled trial. *JAMA* 2004;291:2328-2334
- Reico-Mayoral A, and Co. The reno-protective effect of hydration with sodium bicarbonate plus N-acetylcysteine in patients undergoing emergency percutaneous coronary intervention: the RENO Study. *J Am Coll Cardiol* 2007;49:1283-1288.
- Briguori C, and Co., Renal Insufficiency After Contrast Media Administration Trial II (REMEDIAL II): RenalGuard system in high-risk patients for contrast-induced acute kidney injury. *Circulation*. 2011;124:1260-1269
- Ozcan, and Co., Sodium bicarbonate, N-acetylcysteine, and saline for prevention of radiocontrast-induced nephropathy. A comparison of 3 regimens for protecting contrast-induced nephropathy in patients undergoing coronary procedures. A single-center prospective controlled trial - *American heart journal* 154 (3), 539-544

Hemofiltration in very high risk patients

Cruz DN, Perazella MA, Bellomo R, Corradi V, de Cal M, Kuang D, Ocampo C, Nalessio F, Ronco C. Extracorporeal blood purification therapies for prevention of radiocontrast-induced nephropathy: a systematic review. *Am J Kidney Dis* 2006;48:361-371.

Choice of contrast medium

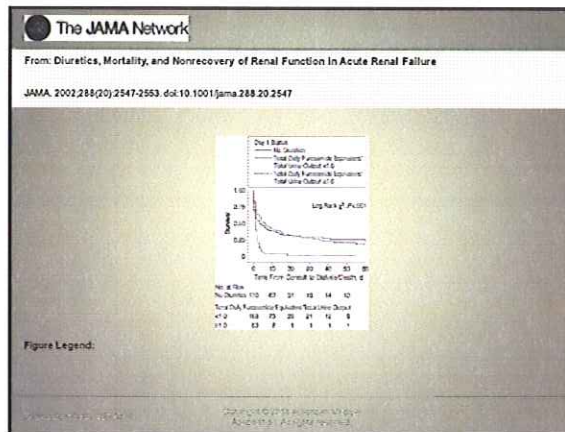
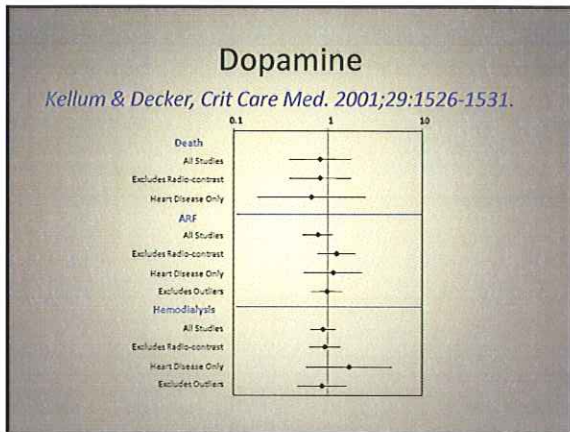
Hypo-osmolar or iso-osmolar contrast

Barrett BJ, Carlisle EJ. - Metaanalysis of the relative nephrotoxicity of high- and low-osmolality iodinated contrast media. *Radiology*. 1993 Jul;188(1):171-8.

MRI ?

Nephrogenic Fibrosing Dermopathy (NFD)
Nephrogenic Systemic Fibrosis (NSF)

*Diuretic-Mania
And
Dopamine-Crania*



Drugs in ICU

Renal Adjustments

- ## Different Disease Processes
- Liver Failure -
 - *Hepatic Renal Syndrome*
 - ARDS
 - Tumor Lysis Syndrome and "Rhabdo"
 - Abdominal compartment Syndrome

Learning Assessment

Which of the following are independent predictors of acute kidney injury in the critical care patient?

- A. Initial plasma potassium level on admission
- B. Older age
- C. Higher APACHE II score on admission
- D. All of the above

Questions