

Acute Kidney Injury

The most deadly disease you've never heard of

If you are hospitalized and very sick (pneumonia, trauma, major surgery, etc.) your kidneys could be damaged, which may go unrecognized.

- U.S. hospital intensive care units (ICUs) admit more than 5 million patients each year.¹
 - Studies suggest that approximately **50 percent** of these patients will develop acute kidney injury (AKI).²
- AKI incidence in the United States is believed to be similar to that of acute myocardial infarction (heart attack).^{3, 4}
- Compared with myocardial infarction, AKI is usually silent.
 - Unlike myocardial infarction, AKI may lack signs and symptoms sufficient to guide risk assessment, particularly in the early stages when intervention is most beneficial.⁴
- There are many AKI risks and exposure factors, including:^{5,6,7,13}
 - Sepsis
 - Pneumonia
 - Cardiogenic Shock
 - Major Surgery
 - Cardiac Surgery
 - Nephrotoxic Drugs
 - Radiocontrast Agents

Everything could be at least twice as bad if you are admitted to an ICU and develop AKI.

- More than twice the length of stay.
 - In a study, published in 2014, of 50,314 adult surgical patients, the median lengths of stay in both the ICU and the hospital were longer:⁸

| | |
|----------|------------------------------|
| ICU | 2 vs 6 days (no AKI vs AKI) |
| Hospital | 5 vs 12 days (no AKI vs AKI) |
- More than twice the cost while you are in the hospital
 - In a study, published in 2008, of 3,741 cardiac surgery patients the cost of AKI was more than double for severe AKI patients.⁹

| | |
|------------|----------|
| No AKI | \$13,800 |
| Severe AKI | \$49,000 |
 - In a study, published in 2014, of 50,314 adult surgical patients the risk-adjusted average cost of care for patients increased dramatically with moderate to severe AKI:⁸

| | |
|--------------|----------|
| No AKI | \$26,700 |
| Moderate AKI | \$45,800 |
| Severe AKI | \$62,600 |

- **More than twice the readmission rate**
 - In a study, published in 2013, of 2,209 patients that underwent coronary artery bypass or valve surgery patients with moderate to severe AKI showed increased 30-day readmission rates.¹⁰

| | |
|--------------|--------------|
| No AKI | 9.3 percent |
| Moderate AKI | 21.8 percent |
| Severe AKI | 28.6 percent |

- **More than twice the chronic kidney complications**
 - In a 2014 review article involving hospitalized Medicare beneficiaries
 - AKI was associated with a risk of end stage renal disease (ESRD) that was 13 times as high as the risk among patients without AKI.¹¹
 - Risk of ESRD was 40 times as high if the patients had both AKI and preexisting CKD.¹¹

- **More than twice the mortality of a heart attack (Myocardial Infarction/MI)**
 - In a recent study, published in 2013 of more than 36,000 hospitalized veterans, death rates at one year were higher among those patients with AKI alone, compared to those patients with MI alone.¹²

| | |
|---------------|------------|
| MI Mortality | 14 percent |
| AKI Mortality | 30 percent |

There Is A Need For Better Assessment Tools

- The UK National Confidential Enquiry into Patient Outcomes and Death (NCEPOD) Adding Insult to Injury AKI study reported in 2009 that of admitted patients who died from hospital acquired AKI:
 - 31 percent had avoidable AKI;
 - 43 percent had an unacceptable recognition delay;
 - 54 percent had inadequate risk assessment.¹³
- As awareness builds, there has been a growing consensus that better diagnostic and predictive tools are needed to reduce the burden of AKI.¹⁴
- The identification of novel AKI biomarkers has been designated a top priority by the American Society of Nephrology (ASN).¹⁵
- The NCEPOD study stated: “*Acute kidney injury (AKI) is potentially fatal, but in many cases reversible when appropriately managed*” and “*...it is reasonable to surmise that, at least in some cases, the [patient] outcomes...may have been different if the condition [AKI] had been recognized and managed better.*”¹³

AKI General Background

How the Kidneys Work

The primary function of the kidneys is to maintain fluid and electrolyte balance within the body and excrete a variety of wastes as urine. They also play a central role in controlling blood pressure and in the formation of new red blood cells.¹⁶

The AKI Burden

- It has been estimated that U.S. annual healthcare expenditures attributable to hospital-acquired AKI could exceed \$10 billion.¹⁷
- It is estimated that AKI affects between 7 and 18 percent of hospital inpatients.¹⁴
- Mortality associated with AKI is significant and is responsible for approximately 2 million deaths annually worldwide.¹⁸

AKI could be thought of as a “Kidney Attack”

In a 2012 editorial published in *JAMA*, the authors suggested that the term “kidney Attack” might get more appropriate attention for AKI.

”There is almost universal public understanding of the concept of a heart attack.... Unlike medical expressions such as myocardial infarction or stroke, lay terms including the word *attack* convey a sense of urgency and importance. Such terms have helped to achieve considerable progress in treatment or outcome by focusing public attention, encouraging early clinician intervention, and establishing a research agenda.”

“By contrast, acute injury to the kidneys is less well understood by clinicians and researchers and is barely known by the public. Perhaps as a result of such lack of understanding and focus, outcomes have improved little in recent years. This is surprising because acute kidney injury (AKI) is common with an incidence (2.1/1000 population) similar to that of acute myocardial infarction. Also, early mortality associated with some forms of AKI is greater than that associated with acute myocardial infarction despite available supportive therapy like dialysis or hemofiltration.”³

What can clinicians do?

Clinicians today have many tools and actions that they initiate with patients when they are concerned with the kidneys. However, it is usually a delayed reaction, after an increase in the patients creatinine and/or a decrease in urine output.¹⁹ The NEPHROCHECK® Test may allow doctors to be proactive and use those same tools and actions earlier.

Astute Medical®, the Astute Medical logo, ASTUTE140®, NEPHROCHECK® and the NEPHROCHECK logo are registered trademarks of Astute Medical, Inc. in the United States. AKIRISK™ is a trademark of Astute Medical, Inc. For information regarding trademarks and other intellectual property applicable to this product, including international trademarks, please see AstuteMedical.com/US/About/IntellectualProperty.
PN0104 Rev D 2014/10/27

-
- ¹ Society of Critical Care Medicine. Critical Care Statistics [accessed 2014 September 24]. Available from: <http://www.sccm.org/Communications/Pages/CriticalCareStats.aspx>.
 - ² Mandelbaum T, Scott D, Lee J, et al. [Outcome of Critically ill Patients with Acute Kidney Injury using the AKIN Criteria](#). *Crit Care Med*. 2011;39(12):2659–2664.
 - ³ Kellum JA, Bellomo R, Ronco C. [Kidney Attack](#). *JAMA*. 2012;307(21):2265-2266.
 - ⁴ Ronco C, Ricci Z. [The Concept of risk and the value of novel biomarkers of acute kidney injury](#). *Crit Care*. 2013;17:117-118.
 - ⁵ Mehta RL, Pascual MT, Soroko S, et al. [Spectrum of acute renal failure in the intensive care unit: the PICARD experience](#). *Kidney Int*. 2004;66:1613-1621.
 - ⁶ Murugan R, Karajala-Subramanyam V, Lee M, et al. [Acute kidney injury in non-severe pneumonia is associated with an increased immune response and lower survival](#). *Kidney Int*. 2010;77:527-535.
 - ⁷ Uchino S, Kellum JA, Bellomo R, et al. [Acute renal failure in critically ill patients: a multinational, multicenter study](#). *JAMA* 2005;294:813-818.
 - ⁸ Hobson CE, Ozrazgat-Baslanti T, Kuxhausen A. [Cost and Mortality Associated With Postoperative Acute Kidney Injury](#). *Annals of Surgery*. 2014;00:1–8.
 - ⁹ Dasta JF, Kane-Gill SL, Durtschi AJ, Pathak DS, and Kellum JA. [Costs and outcomes of acute kidney injury \(AKI\) following cardiac surgery](#). *Nephrol. Dial. Transplant*. 2008;23:1970-1974.
 - ¹⁰ Brown JR, Parikh CR, Ross CS, et al. [Impact of perioperative acute kidney injury as a severity index for thirty-day readmission after cardiac surgery](#). *Ann Thorac Surg*. 2014;97(1):111-7.
 - ¹¹ Chawla LS, Eggers P, Star R. [Acute Kidney Injury and Chronic Kidney Disease as Interconnected Syndromes](#). *N Engl J Med*. 2014;371:58-66.
 - ¹² Chawla L, Amdur RL, Shaw AD, Faselis C, Palant CE, Kimmel PL. [Association between AKI and Long-Term Renal and Cardiovascular Outcomes in United States Veterans](#). *Clin J Am Soc Nephrol*. 2014;9:1-9.
 - ¹³ National Confidential Enquiry into Patient Outcome and Death. [Adding Insult to Injury](#). 2009;1-98.
 - ¹⁴ Lewington AJP, Certa J, Mehta RL [Raising Awareness of Acute Kidney Injury: A Global Perspective of a Silent Killer](#). *Kidney Int*. 2013;84(3):457-467.
 - ¹⁵ American Society of Nephrology [Renal Research Report](#). *J Am Soc Nephrol*. 2005;16:1886-1903.
 - ¹⁶ National Kidney and Urologic Diseases Information Clearinghouse. The Kidneys and How They Work [accessed 2014 September 24]. Available at: <http://kidney.niddk.nih.gov/kudiseases/pubs/yourkidneys/>.
 - ¹⁷ Chertow GM, Burdick E, Honour M, Bonventre JV, and Bates DW. [Acute kidney injury, mortality, length of stay, and costs in hospitalized patients](#). *J. Am. Soc. Nephrol*. 2005;16:3365-3370.
 - ¹⁸ Chawla L, Kimmel P. [Acute Kidney Injury and Chronic Kidney Disease](#). *Kidney Int*. 2012;82(5):516-524.
 - ¹⁹ Ronco C. Kidney Attack: [Overdiagnosis of Acute Kidney Injury or Comprehensive Definition of Acute Kidney Syndromes?](#) *Blood Purif*. 2013;36(2):65-68.