ACUTE KIDNEY INJURY

A SERIOUS RENAL COMPLICATION$^1-4$
AKI AWARENESS

DEFINITION OF AKI
According to the KDIGO Clinical Practice Guideline, AKI is defined as any of the following (not graded):

- Increase in SCr by ≥0.3 mg/dL (≥26.5 µmol/L) within 48 hours; or
- Increase in SCr to ≥1.5 times baseline, which is known or presumed to have occurred within the prior 7 days; or
- Urine volume <0.5 mL/kg/h for 6 hours

INCIDENCE OF AKI
- Worldwide, approximately 20% of hospitalized patients have AKI.
- Approximately 20–60% of adult ICU patients have AKI; about 15–25% of these patients receive RRT.
- Approximately 27% of paediatric and young adult ICU patients develop AKI during the first week after admission.
- AKI may be under-recognized in hospitalized patients in some countries.
- The incidence of dialysis-requiring AKI has increased in some countries.

*One study included patients aged >15 years.
Data are from a prospective observational study of AKI in ICU patients from September 2000 to December 2001 at 54 hospitals in 23 countries. AKI was defined as urine output <200 mL in 12 hours and/or BUN >84 mg/dL (>30 mmol/L). Factors contributing to AKI for 1726 patients are shown above as % (n); more than one factor may have been reported for each patient.21
AKI is associated with an increased risk of CKD, including ESRD\textsuperscript{23-25}

\textbf{KEY STUDY TAKEAWAY}

AKI may progress to or worsen CKD, or result in ESRD\textsuperscript{22}

The graphic above depicts potential courses of a patient after AKI\textsuperscript{22}.

\textbf{NATURAL HISTORY OF AKI}\textsuperscript{22}

- Patient may undergo complete recovery
- Patient may develop progressive CKD
- Patient may suffer an irreversible loss of kidney function that evolves to ESRD
- Patient may experience exacerbation of rate of progression of pre-existing CKD

Even mild AKI is associated with an increased risk of long-term mortality, while moderate or severe AKI is associated with a 3-fold increase in mortality vs no AKI.
POTENTIAL APPLICATIONS FOR RRT

Renal replacement
- Traditional approach based on utilization of RRT with little or no residual kidney function

Life-threatening indications*
- Hyperkalaemia
- Acidaemia
- Pulmonary oedema
- Uraemic complications

Non-emergent indications
- Solute control
- Fluid removal
- Correction of acid–base abnormalities

Renal support†
- Volume control
- Nutrition
- Drug delivery
- Solute modulation
- Regulation of acid–base and electrolyte status

*The KDIGO Clinical Practice Guideline recommends initiating RRT emergently for life-threatening changes in fluid, electrolyte, or acid-base balance (recommendation is not graded but is based on wide acceptance that these conditions necessitate emergent dialysis).
†Based on the utilization of RRT as an adjunct to enhance kidney function, modify fluid balance, and control solute levels.
An estimated 2–14% of ICU patients may require RRT for AKI.\textsuperscript{6-10}

While estimates vary by study, dialysis-requiring AKI is common among critically ill patients.\textsuperscript{6-10}
FLUID OVERLOAD MAY ADVERSELY IMPACT AKI PATIENT PROGNOSIS

Fluid overload at RRT initiation for AKI has been associated with an increased risk of 90-day mortality.\(^\text{27}\)

**Consequences of fluid overload may lead to organ dysfunction\(^\text{28}\)**

Fluid overload in AKI patients was independently associated with mortality.\(^\text{27}\)

**KEY STUDY TAKEAWAY**

Fluid overload may be associated with serious complications in multiple organs.\(^\text{28}\)

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FLUID ACCUMULATION OVER TIME WITH CRRT AND IHD IN THE PICARD STUDY$^{30,*}$

PICARD was a prospective, observational study of 618 critically ill patients with AKI at five centres in North America from February 1999 to August 2001. The objective was to determine whether fluid accumulation is associated with mortality and non-recovery of kidney function.$^{30}$

Figure adapted from Bouchard J, et al. Kidney Int. 2009;76(4):422-427.

*Details of data collection and statistical analysis were not reported.

CRRT is a preferred RRT by many clinicians for patients with AKI who are haemodynamically unstable.$^{5,31}$

Patients who received CRRT had reduced accumulation over time compared with those who received IHD$^{30,*}$
LONG-TERM OUTCOMES

ACUTE RRT MODALITY TYPE MAY IMPACT THE RISK OF LONG-TERM DIALYSIS DEPENDENCE\textsuperscript{32-35}

INCIDENCE OF CHRONIC DIALYSIS BY INITIAL RRT MODALITY FOR PATIENTS WITH AKI SURVIVING TO 90 DAYS\textsuperscript{32}

<table>
<thead>
<tr>
<th>RRT Type</th>
<th>Events (%)</th>
<th>Incidence per 100 person-years</th>
<th>HR (95% CI) (CRRT vs IHD)</th>
</tr>
</thead>
<tbody>
<tr>
<td>CRRT (n=2004)</td>
<td>435 (22)</td>
<td>6.5</td>
<td>0.75 (0.65, 0.87)</td>
</tr>
<tr>
<td>IHD (n=2004)</td>
<td>533 (27)</td>
<td>8.2</td>
<td></td>
</tr>
</tbody>
</table>

Retrospective, multicentre, cohort study of critically ill adults who initiated dialysis for AKI between 1996 and 2009. Patients initially treated with CRRT were propensity matched with those initially treated with IHD, and rates of dialysis dependence from day 90 to the end of the follow-up period were compared. The follow-up period was until death or 31 March, 2011. Dialysis dependence was defined as the receipt of dialysis for at least 90 days.\textsuperscript{32}

KEY STUDY TAKEAWAY

Patients treated with IHD had a higher risk of chronic dialysis following an initial AKI episode compared with patients treated with CRRT\textsuperscript{32}

Use of CRRT for AKI management has been associated with a lower risk of chronic dialysis compared with IHD\textsuperscript{32-35}
Health outcomes and healthcare costs were modelled and averaged for 1000 patients initiated on CRRT and 1000 patients initiated on IRRT. All costs were inflated to 2013 USD.³⁶

**KEY STUDY TAKEAWAY**

The long-term cost of AKI may be lower for patients initially treated with continuous therapy compared with those treated with intermittent therapies.³⁶
AKI AND ECONOMIC IMPLICATIONS

AKI MAY BE ASSOCIATED WITH A SUBSTANTIAL FINANCIAL BURDEN

PATIENTS WITH AKI HAD SIGNIFICANTLY HIGHER DAILY COSTS COMPARED WITH PATIENTS WITHOUT AKI

<table>
<thead>
<tr>
<th>Acute medical condition</th>
<th>Adjusted mean cost difference in 2012 USD (95% CI)*</th>
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<tbody>
<tr>
<td>AKI-D†</td>
<td>11,016 (10,468, 11,564)</td>
</tr>
<tr>
<td>Sepsis</td>
<td>4822 (4696, 5068)</td>
</tr>
<tr>
<td>VTE</td>
<td>3782 (3611, 3953)</td>
</tr>
<tr>
<td>Acute pancreatitis</td>
<td>1802 (1676, 1929)</td>
</tr>
<tr>
<td>AKI‡</td>
<td>1795 (1692, 1899)</td>
</tr>
<tr>
<td>Pneumonia</td>
<td>1705 (1584, 1825)</td>
</tr>
<tr>
<td>Stroke</td>
<td>1427 (1281, 1573)</td>
</tr>
<tr>
<td>MI</td>
<td>14 (−91, 119)</td>
</tr>
<tr>
<td>Gl bleed</td>
<td>−860 (−961, −759)</td>
</tr>
</tbody>
</table>

*Compared with reference group without the condition of interest.
†Compared with patients without AKI.
‡AKI group includes patients with AKI-D.

THE INCREMENTAL COST OF AKI-D OR AKI WAS HIGHER THAN MANY OTHER CONDITIONS FOUND IN HOSPITALIZED PATIENTS

KEY STUDY TAKEAWAY

AKI was expensive relative to other acute medical conditions

While expenditures may vary by country, AKI is a costly condition

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Postoperative AKI is associated with a substantial financial burden. In a retrospective US cohort study of 50,314 adult patients undergoing major inpatient surgery with no history of CKD, AKI developed in approximately 39% of patients, with approximately 9% of them receiving RRT.

RISK-ADJUSTED AVERAGE COST OF POSTOPERATIVE CARE FOR SURGICAL PATIENTS WAS $42,600 FOR AKI VERSUS $26,700 FOR NO AKI, REPRESENTING 159% HIGHER HOSPITAL COSTS FOR AKI VERSUS NO AKI.

P<0.001 for all groups compared with the no AKI group.
*Data are from the USA; costs may vary by location.

KEY STUDY TAKEAWAY
AKI added significantly to postoperative hospital costs, even among patients with mild AKI.
To learn more about AKI and CRRT, please visit: www.baxter.com/healthcare-professionals/critical-care