

# Long-Term Follow-up of Acute Kidney Injury



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## KEYWORDS

- Acute kidney injury • Outcome • Follow-up • Critical illness • Critical care
- Intensive care

## KEY POINTS

- Acute kidney injury (AKI) during critical illness has a high incidence. The standardized definitions of AKI have helped identify patients at risk and have highlighted worsening long-term outcomes in these patients.
- The development of a single episode of AKI during critical illness predisposes to chronic kidney disease (CKD).
- Active management with continuous renal replacement therapy (RRT), when indicated; appropriate fluid therapy; early nephrology referral; and on-going monitoring of renal parameters after the initial step down from an intensive care unit will hopefully improve long-term outcomes for AKI.
- Renal recovery may be more difficult to define than originally envisaged. Clinicians should be aware of the limitations of using creatinine as a marker of the glomerular filtration rate (GFR), particularly in those recovering from multiorgan failure where renal insufficiency may be overlooked.

## INTRODUCTION

AKI confers an increased mortality risk owing to the interplay between the concomitant acidosis, volume overload, electrolyte disturbance, increased susceptibility to infection, and the impact on other organ functions that may ensue.<sup>1</sup> The sequelae of renal injury, however, are not limited to the acute episode, with growing evidence supporting the observation that an episode of AKI may increase the risk of both morbidity and mortality in the longer term.<sup>2</sup> This is of significance given that AKI is a

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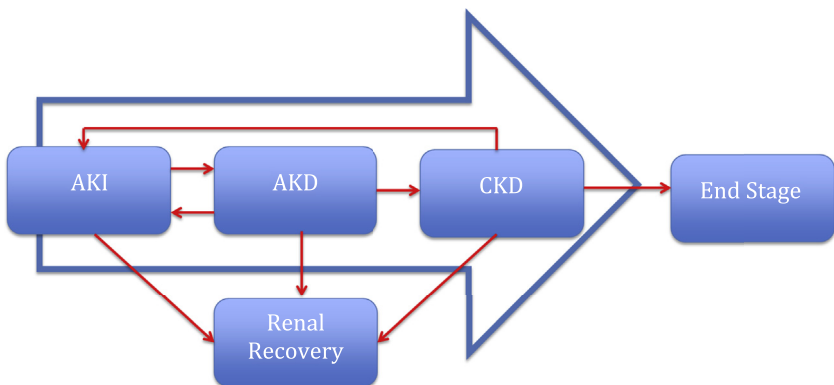
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common encounter in the general hospital setting where 15% of admitted patients sustain an episode of AKI, and in critical care this increases to over 25% whereas in pediatric practice the incidence varies depending on casemix.<sup>3,4</sup> The acute mortality of all critically ill patients has improved over the past 16 years but patients whose critical illness is complicated by AKI have a significantly higher risk of mortality, with this risk continuing for at least 2 years after the index ICU admission.<sup>5</sup> Furthermore, despite a temporal trend demonstrating a reduced risk of dialysis dependence after an episode of AKI, there are potentially more patients surviving, thereby increasing the burden on the health economy further.<sup>6</sup> This is reflected in the total annual cost of AKI-related inpatient care, which has been estimated at £1.02 billion, or just over 1% of the National Health Service budget, in the United Kingdom.<sup>7</sup> As a consequence, it is no surprise that the long-term outcome for patients with AKI, examining mortality, morbidity, and quality of life, is now receiving appropriate attention.<sup>8,9</sup> This article discusses some of the limitations in defining renal recovery using conventional methods and considers how the acute management of patients with AKI may influence long-term outcomes. The issue of identification of patients who may benefit from enhanced follow-up is addressed and long-term management principles for patients who have had an episode of AKI is considered.

## DEFINING RECOVERY

### *What Is Meant by Recovery?*

Since the first description of the Risk, Injury, Failure, Loss of Kidney Function, and End-stage Kidney Disease (RIFLE) criteria, the definition of AKI has undergone several reincarnations. More recently the Kidney Disease: Improving Global Outcomes (KDIGO) guidelines define AKI according to changes in serum creatinine and urine output and classify AKI by stages 1, 2, and 3.<sup>10</sup> Similarly, CKD is also defined by KDIGO and reflects both chronic structural change to the kidneys and functional change, for example, in terms of creatinine clearance.<sup>11</sup> The definition of CKD requires at least 2 creatinine estimations at least 90 days apart, which has led to the concept of acute kidney disease (AKD), which describes the transition between the acute and chronic states.<sup>12</sup> This in itself, however, is not straightforward. Fig. 1 outlines the potential course of patients recovering from an episode of AKI. They may recover function (the definition of which is discussed) or progress to AKD. Further insult may lead,



**Fig. 1.** Schematic describing the potential course of a patient surviving an episode of AKI.

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