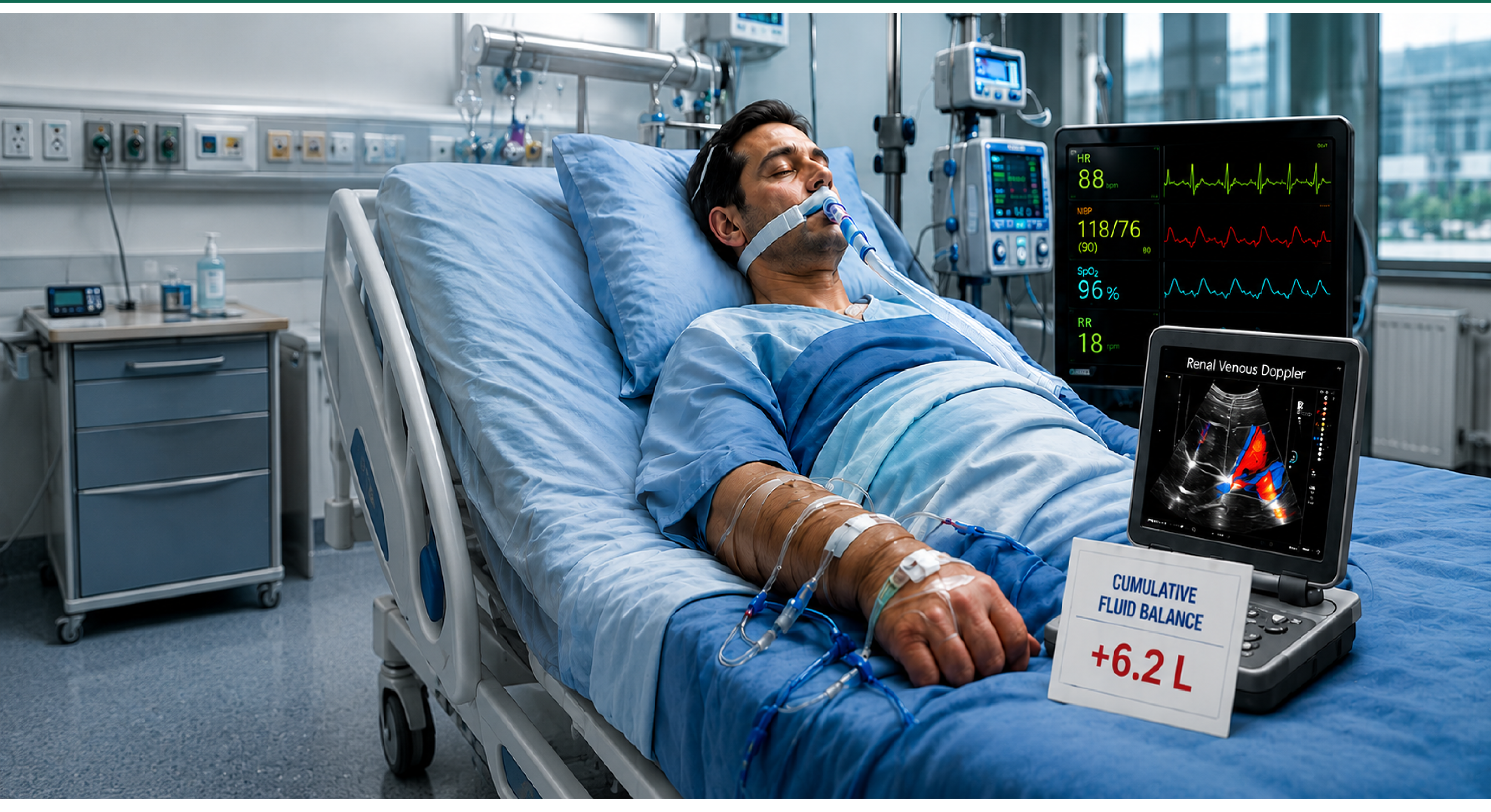
FLUID OVERLOAD:

THE PREVENTABLE CAUSE OF ICU-RELATED ACUTE KIDNEY INJURY



1. The Hidden Driver of AKI

Acute Kidney Injury (AKI) affects up to 40–60% of ICU patients and is associated with increased mortality, prolonged hospitalization, and progression to chronic kidney disease. Traditionally, AKI in critical illness has been attributed to hypotension, ischemia-reperfusion injury, and sepsis-related inflammation.[1,2]

However, growing evidence suggests that fluid overload is not merely a consequence of critical illness—it may directly contribute to renal dysfunction and poorer outcomes.[1,3]

2. Rethinking AKI: The Role of Congestion

Renal Venous Congestion and Interstitial Edema.[4]

The kidneys are particularly vulnerable to congestion because of their low-pressure vascular bed and relatively non-compliant capsule. Elevated renal venous pressure can reduce glomerular filtration even when arterial perfusion appears adequate.[4]

Payen et al. demonstrated that a positive cumulative fluid balance was independently associated with increased mortality and organ dysfunction, including AKI.[5,6]

CLINICAL CLUES

Congestion-driven AKI may present with:

- Oliguria unresponsive to fluid boluses
- Rising serum creatinine with generalized edema
- Elevated central venous pressure or venous Doppler ab normalities
- Worsening oxygenation accompanying fluid accumulation[4,5]

3. When More Fluid Becomes Harmful

Intravenous fluids remain essential during early shock resuscitation. However, beyond initial stabilization, continued liberal fluid administration may become increasingly harmful.[1,7]

KDIGO recommends a phase-based approach[12] to fluid management:

- Resuscitation
- Stabilization
- De-resuscitation[12]

Practical strategies include:

- Early vasopressor initiation
- Dynamic assessment of fluid responsiveness
- Discontinuation of unnecessary maintenance fluids
- Early transition to neutral or negative fluid balance[7,12]

4. Fluid Overload and Renal Replacement Therapy

Traditionally, the decision to initiate Renal Replacement Therapy (RRT) focused on metabolic and electrolyte abnormalities. Increasing evidence now supports fluid overload as an important indication for intervention.[8,9]

Bouchard et al. reported significantly higher mortality and lower rates of renal recovery among AKI patients who initiated RRT with greater than 10% fluid accumulation relative to body weight.[9]

Recent KDIGO recommendations advocate individualized timing of RRT based on:

- Degree of fluid overload
- Respiratory status
- Feasibility of conservative fluid removal[7,8]

5. Can Albumin Support Fluid Stewardship?

In sepsis and systemic inflammation, capillary leak reduces the effectiveness of crystalloids. Albumin may help restore circulating volume with less overall fluid exposure, potentially limiting tissue edema and fluid accumulation.[10]

Evidence from the SAFE and ALBIOS trials supports its safety and suggests benefits such as improved hemodynamics, reduced vasopressor requirements, and lower cumulative fluid balance in selected patients.[10,11]

Current KDIGO guidance recommends a selective, individualized approach, particularly in hypoalbuminemic patients with fluid overload.[7]

6. Looking Beyond Blood Pressure

Managing AKI is no longer solely about restoring perfusion. Increasing evidence suggests that congestion and fluid accumulation are important drivers of renal injury—even when conventional hemodynamic targets are achieved.[3,5]

Recognizing fluid overload early and adopting a stewardship approach to fluid therapy may offer an opportunity to improve both renal and patient-centered outcomes.[7,12]

Key Takeaways

- Fluid overload independently worsens AKI outcomes
- Congestion-driven AKI can occur despite preserved blood pressure
- Fluid accumulation should influence RRT timing decisions
- Albumin may have a selective role in fluid stewardship and de-resuscitation

Clinical Pearl

Treat fluids like a drug. The right fluid, in the right patient, at the right time can be lifesaving. Beyond that point, avoiding fluid overload may be equally important.

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*The cases presented are hypothetical in nature and intended for illustrative purposes only. The management strategies discussed are evidence-based and aligned with established clinical guidelines and scientific literature.

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