Global Perspectives in Acute Kidney Injury: England

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Introduction
The publication of the National Confidential Inquiry of Patient Outcomes and Deaths report “AKI: Adding Insult to Injury” in 2009 led to questions being asked in the Houses of Parliament as to why patients who died from AKI only received good care in 50% of cases (1). A Department of Health AKI Delivery Board was established to address this and other issues raised in the report. A wide-ranging program of activities was established to raise awareness of AKI that included improving education for all health care professionals (2) and developing national guidelines on the management of patients with AKI (3).

Epidemiology of AKI
The true epidemiology of AKI in England remains unknown due to the heterogeneity of the condition and the failure to recognize and therefore code accurately. In 2014, a National Health Service (NHS)-wide AKI warning system was introduced in England to try and improve the detection of AKI (4). An algorithm was developed on the basis of the Kidney Disease Improving Global Outcomes (KDIGO) definition of AKI and integrated into the NHS laboratory information management systems (5). Any patient experience a rise in serum creatinine meeting the KDIGO definition of AKI is identified with an AKI warning. In 2018, there were 1,524,398 AKI alerts for 488,856 people in England, which represented 564,738 AKI episodes (76% of people had one AKI episode, 17% had two episodes, and 7% had more than two episodes). This equates to 123,000 episodes, with wide regional variation from 5300 to 20,700 per million population (6). Seventy-one percent of people with an AKI episode had a hospital stay: 39% with community-acquired AKI, and 32% with hospital-acquired AKI.

Detection and Diagnosis of AKI
The diagnosis of AKI is based upon the medical assessment of the clinical presentation alongside the review of the rise in serum creatinine that triggers an AKI alert. Unfortunately, urine output is often poorly monitored and therefore frequently excluded from the assessment. Patients who have been identified as having experienced a clinical episode of AKI are then coded using the 10th revision of the International Statistical Classification of Diseases and Related Health Problems coding for AKI.

The NHS utilizes an AKI warning system that alerts clinicians that a patient has experienced a rise in serum creatinine consistent with the KDIGO AKI consensus definition. The AKI alert also stages the severity of the episode depending on the magnitude of the rise in creatinine above a predetermined baseline value. The date of a first AKI episode is defined as the date of the first AKI alert received by the UK Renal Registry from any laboratory. Subsequent alerts are only considered to be a further episode of AKI if at least 30 days have passed since the last alert (Figure 1).

It is recognized that the alert system will not detect all episodes of AKI, and it remains very much the role of the clinician to determine whether a patient has a clinical diagnosis of AKI. Urine output measurement is generally poorly performed outside of the intensive care unit (ICU) and kidney units. With the continued digitalization of the NHS, it is hoped this will improve, with the measurement of urine output being integrated into electronic observations. This will improve the accuracy of urine output monitoring and eventually allow AKI warning systems to be developed on the basis of the urine output to complement the serum creatinine AKI warning systems.

Despite the availability of a number of new biomarkers for AKI none of them have been approved for use in the NHS. Following a rigorous review of the available evidence the recent National Institute of Health and Care Excellence (NICE) Diagnostic guidance for NGAL and NephroCheck failed to demonstrate sufficient evidence to support their use to assess the risk of acute kidney injury for people being considered for critical care admission (7). NICE recommended that further research was required to assess the clinical effectiveness of biomarkers used with defined care bundles to prevent or reduce the effect of AKI in defined NHS patient populations who could benefit from preventive care. This was in agreement with the recommendations from an earlier National Institute for Health and Care Research Human Technology Appraisal report (8).

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Prevention of AKI in High-risk Patients

After the publication of the National Confidential Inquiry of Patient Outcomes and Deaths “Acute Kidney Injury: Adding Insult to Injury” report in 2009, there was a concerted effort to improve the recognition and management of AKI (2). This resulted in the development of new postgraduate national training curricula to include AKI and the production of national guidelines to prevent the development of AKI in high-risk patients (3). Currently, there is no widespread use of AKI prediction models or equations. Attempts to try and develop a validated AKI risk prediction model have proven fruitless (9). The most recent national guidance on the prevention of AKI has been published by NICE (3). The guidance includes the use of track and trigger systems to detect patients at risk of developing AKI, reviewing medications, and maintaining good hydration to prevent contrast-induced AKI.

Provision of Care for Patients with AKI

The NHS was formed in 1948 to provide free health care at the point of care, and this continues to the current day. It would be a very brave politician who would propose any dramatic change to this underlying principle of health care. In 2019–2020, there were 141,000 NHS acute care beds in England, with around 5000 critical care beds. Approximately a quarter of NHS hospitals in England have dedicated kidney units that can deliver kidney replacement therapy (KRT). Those NHS hospitals without onsite nephrology services are served remotely by one of the 52 dedicated referral kidney units across England. ICUs across England vary as to whether they are open or closed in their approach to patient care. Open ICUs allow the patient’s admitting team to continue to contribute to care of the patient during the ICU stay and importantly provide continuity of care if the patient recovers and is discharged back to the general ward.

Provision of KRT

In England, patients on ICU with multiorgan failure who develop AKI receive KRT, which is usually delivered by the intensivists. In the majority of cases, this is a continuous modality that can be delivered by the intensive care nursing team. Patients with single-organ AKI who do not need ICU care but need KRT should be managed by the nephrology team. However, if a hospital does not have an on-site dedicated kidney unit and a patient cannot be transferred to the nearest kidney unit in a timely manner, the patient may have to receive KRT in the local ICU until a bed has been made available in the nearest specialist kidney unit.

Most ICUs in England provide a continuous form of KRT for patients with AKI. The most common forms of continuous KRT utilized across the NHS in England are continuous

Table 1. Adjusted (men aged 65–74 years) 30-day mortality for patients with an AKI episode by clinical setting in 2017

| Setting of AKI Episode                      | All AKI episodes | Community Acquired | Community Acquired, Subsequently Hospitalized | Hospital Acquired |
|--------------------------------------------|------------------|-------------------|-----------------------------------------------|-------------------|
| Number of patients                         | 441,699          | 127,767           | 171,266                                       | 142,666           |
| % of patients                              |                  | 29                | 39                                            | 32                |
| % of patients who died by 30 days from AKI start | 18               | 8                 | 21                                            | 24                |
| Adjusted mortality (%) by peak AKI stage    |                  |                   |                                               |                   |
| 1                                          | 12               | 6                 | 14                                            | 16                |
| 2                                          | 26               | 21                | 25                                            | 31                |
| 3                                          | 28               | 22                | 26                                            | 37                |
venovenous hemofiltration and continuous venovenous hemodialysis. Patients with AKI are primarily cared for by the intensivists, with nephrology input varying from unit to unit. Rarely, an ICU can provide both a continuous form of KRT and intermittent hemodialysis (for appropriate hemodynamically stable patients). In this case, the intermittent hemodialysis is provided by the nephrology team. More recently, there has been an increase in the use of citrate anticoagulation, although doubts remain about the economic benefit. There are very few units that have the specialized skills to deliver peritoneal dialysis routinely for patients with AKI.

Outcomes after AKI

The first national AKI report for England published by the UK Renal Registry in 2018 provided much-needed information on patient outcomes after an episode of AKI (6). It was reported that 18% of people with an AKI episode died within 30 days of the first alert, with an increase in 30-day mortality as AKI stage increased (Table 1). Mortality was 13% for AKI stage 1, 29% for AKI stage 2, and 33% for AKI stage 3. Mortality in the first 30 days also increased with age, from 3% in children to 26% in adults aged >75 years. Mortality within 30 days was higher for people from deprived areas after accounting for their lower median age. There was seasonal variation, with more deaths occurring in winter. Mortality within 30 days was higher at 24% in people whose AKI episode started in hospital compared with 8% for people with an AKI who were never hospitalized. Median length of stay in hospital with an AKI episode was 12 days and was more than double in hospital-acquired AKI than in community-acquired, subsequently hospitalized AKI, for both elective and emergency admissions. As yet, it is too soon to provide robust data on the development of CKD or kidney failure requiring long-term KRT.

Coronavirus Disease 2019 and AKI

A recent study at a large hospital in England demonstrated 26% of coronavirus disease 2019 (COVID-19) patients had AKI, and mortality was significantly higher in this group compared with those who did not have AKI. The length of stay for COVID-19 patients who developed AKI was significantly longer at 16.5 days versus 7 days in those COVID-19 patients who did not develop AKI (10).

Long-Term Follow-Up

National guidance from NICE states that all patients with AKI should be followed up in primary care, with bloods rechecked 6 months after an acute episode of AKI, and sooner as required (3). This is often left to the community practitioners who are responsible for the patient’s long-term care. A number of initiatives have been used to assist in improving this, including improving the documentation of AKI at the transition of care between secondary and primary care. However, many patients are still not followed up. There are new services emerging that are utilizing advanced nurse practitioners to provide AKI follow-up clinics, bridging the gap between hospital and home. Patients with significant CKD after an episode of AKI should be referred to nephrology.

Future Challenges

Despite an increased awareness of AKI across the NHS, there are a number of challenges that remain for the continued care of patients with AKI. Over recent years, there has been a reduction in acute care beds, which has made it increasingly difficult to transfer patients with AKI to dedicated kidney units for specialist care. There remains a need to improve the follow-up of patients who have experienced an in-hospital episode of AKI and to identify those at risk of a further episode of AKI or developing CKD. A number of these issues have been identified in the “Getting It Right First Time” review of renal medicine (11). NHS England has recently commissioned the Renal Services Transformation Program to try and implement some of the report’s recommendations (11).

Disclosures

A. Lewington reports honoraria from BMJ (expert advisor 2018–present), and an advisory or leadership role for Leeds National Institute for Health and Care Research MIC (associate clinical director). B. Bonfield reports being a member of the UK Kidney Association AKI SIG, a member of the Association of Nephrology Nurses, chair of AKI SIG, and a member of ANN Renal Research SIG.

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Author Contributions

Both authors wrote the original draft of the manuscript and reviewed and edited the manuscript.

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