Management of AKI in Paediatrics

Mignon McCulloch
Associate Professor
Consultant PICU/Paediatric Nephrologist
Red Cross Children’s Hospital (RXH)
University of Cape Town
Prevention is Better than Cure
Mortality after Fluid Bolus in African Children with Severe Infection

Kathryn Maitland, M.B., B.S., Ph.D., Sarah Kiguli, M.B., Ch.B., M.Med.,
Peter Olupot-Olupot, M.B., Ch.B., Samuel O. Akech, M.B., Ch.B.,
Richard Nyeko, M.B., Ch.B., M.Med., George Mtove, M.D., Hugh Reyburn, M.B., B.S.,
Trudie Lang, Ph.D., Bernadette Brent, M.B., B.S., Jennifer A. Evans, M.B., B.S.,
James K. Tibenderana, M.B., Ch.B., Ph.D., Jane Crawley, M.B., B.S., M.D.,
and Diana M. Gibb, M.B., Ch.B., M.D., for the FEAST Trial Group*

CONCLUSIONS

Fluid boluses significantly increased 48-hour mortality in critically ill children with impaired perfusion in these resource-limited settings in Africa. (Funded by the Medical Research Council, United Kingdom; FEAST Current Controlled Trials number, ISRCTN69856593.)
What if fluid was considered as an IVI drug?

FLUID RESUSCITATION WITH COLLOID AND CRYSTALLOID SOLUTIONS IS A ubiquitous intervention in acute medicine. The selection and use of resuscitation fluids is based on physiological principles, but clinical practice is determined largely by clinician preference, with marked regional variation. No ideal resuscitation fluid exists. There is emerging evidence that the type and dose of resuscitation fluid may affect patient-centered outcomes.

Despite what may be inferred from physiological principles, colloid solutions do not offer substantive advantages over crystalloid solutions with respect to hemodynamic effects. Albumin is regarded as the reference colloid solution, but its cost is a limitation to its use. Although albumin has been determined to be safe for use as a resuscitation fluid in most critically ill patients and may have a role in early sepsis, its use is associated with increased mortality among patients with traumatic brain injury. The use of hydroxyethyl starch (HES) solutions is associated with increased rates of renal-replacement therapy and adverse events among patients in the intensive care unit (ICU). There is no evidence to recommend the use of other semisynthetic colloid solutions.
2. FLUID MANAGEMENT IN CHILDREN WITH SIGNS OF IMPAIRED CIRCULATION

Children who are not in shock but have signs of circulatory impairment

| 2.1 | Children with only one or two signs of impaired circulation – cold extremities or capillary refill > 3 s or a weak and fast pulse – but who do not have the full clinical features of shock, i.e. all three signs present together, should not receive any rapid infusion of fluids but should still receive maintenance fluids appropriate for their age and weight. |
|     | Strong | High |
| 2.2 | In the absence of shock, rapid IV infusion of fluids may be particularly harmful to children who have severe febrile illness, severe pneumonia, severe malaria, meningitis, severe acute malnutrition, severe anaemia, congestive heart failure with pulmonary oedema, congenital heart disease, renal failure or diabetic ketoacidosis. | Strong | High |
| 2.3 | Children with any sign of impaired circulation, i.e. cold extremities or prolonged capillary refill or weak, fast pulse, should be prioritized for full assessment and treatment and reassessed within 1 h. | Strong | High |
THROWING THE BABY OUT WITH THE BATHWATER...

TRUST ME. I'M A DOCTOR
Package of care including *examining patients carefully* in Emergency room

- Reduce AKI – individualise care
- Crystalloid type – N/S vs Balanced solutions
- Hypotension vs Antibiotics
- SVO2 vs USCOM
- Peripheral inotropes
- Intra-abdominal pressure via urinary catheter
- Renal blood flow scan
Fluid overload in children

- Increase ventilation days
- Increase ICU stay
- Increase mortality

Arikan Ped Crit Care Med 2012;13:253
Valentine Crit Care Med 2012 40:2883
Sinitsky Ped Crit Care Med 16:205
Bhaskar Intensive Care Medicine 2015 41: 1446
Paridon Critical Care 2015 19: 293
Role of Fluid after admission

- FO >20% @ time of CRRT initiation

\[
\% FO = \frac{(\text{Fluid In} - \text{Fluid Out})}{(\text{PICU Admission weight})} \times 100%
\]


- But what happens before?
Fluid Management in Acute Kidney Injury

Stuart L. Goldstein, MD

Resuscitation

Maintenance/Homeostasis

Removal/Recovery

Journal of Intensive Care Medicine
2014, Vol. 29(4) 183-189
AKI UO less than 0.5ml/kg/hr x 6 hours

AWARE – 5000 paed cases in 31 PICU 2014

NEJM 2017

- Severe AKI – UO & Creatinine (KDIGO 2012)
- Odds ratio 1.77 increased ratio of death associated with morbidity and mortality
- Attention at R of RIFLE

Biomarkers – use clinically

Renal Angina
## Renal Angina Index

### Risk Groups

- **Very high**
- **High**
- **Moderate**

### Renal Angina = risk of AKI * signs of injury

#### Risk

<table>
<thead>
<tr>
<th>Study</th>
<th>Patients</th>
<th>AKI incidence</th>
</tr>
</thead>
<tbody>
<tr>
<td>Schneider <em>et al.</em></td>
<td>PICU admissions</td>
<td>4.5–10%</td>
</tr>
<tr>
<td>Michael <em>et al.</em></td>
<td>Stem cell transplantation</td>
<td>11–21%</td>
</tr>
<tr>
<td>Akcan-Arikan <em>et al.</em></td>
<td>Ventilation and inotropy</td>
<td>&gt; 50%</td>
</tr>
</tbody>
</table>

#### Injury

- **↓eCrCl**
- **↑ICU % FO**

<table>
<thead>
<tr>
<th>Study</th>
<th>Outcomes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Foland</td>
<td>1.78 OR death for each 10% FO</td>
</tr>
<tr>
<td>Goldstein (ppCRRT)</td>
<td>Survival: &lt;20% = 58%, &gt;20% = 40%</td>
</tr>
<tr>
<td>Sutherland (ppCRRT)</td>
<td>OR death 8.5 for &gt; 20% FO</td>
</tr>
</tbody>
</table>

#### Score

- **Moderate**: 1
- **High**: 3
- **Very high**: 5

### Renal angina index (1–40)

\[
\text{Risk index} = (\text{Risk} \times \text{Score})
\]
Epidemiology of Acute Kidney Injury in Critically Ill Children and Young Adults

Ahmad Kaddourah, M.D., Rajit K. Basu, M.D., Sean M. Bagshaw, M.D., and Stuart L. Goldstein, M.D., for the AWARE Investigators*
Incidence

Assessment of Worldwide AKI, Renal Angina and Epidemiology in Children: The International AWARE Study
<table>
<thead>
<tr>
<th>Variable</th>
<th>Bivariate analysis</th>
<th>Multivariable logistic regression model</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Survivors</td>
<td>Non-Survivors</td>
</tr>
<tr>
<td>Primary PICU diagnosis group, n (%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Shock</td>
<td>1101 (22.9)</td>
<td>92 (54.4)</td>
</tr>
<tr>
<td>Cardiovascular</td>
<td>178 (3.7)</td>
<td>28 (16.6)</td>
</tr>
<tr>
<td>Respiratory</td>
<td>1814 (37.7)</td>
<td>87 (51.6)</td>
</tr>
<tr>
<td>Surgical/Trauma</td>
<td>1481 (30.8)</td>
<td>12 (7.1)</td>
</tr>
<tr>
<td>CNS/Neurology</td>
<td>873 (18.1)</td>
<td>46 (27.2)</td>
</tr>
<tr>
<td>Pain/Sedation</td>
<td>164 (3.4)</td>
<td>2 (1.1)</td>
</tr>
<tr>
<td>History of Transplantation, n (%)</td>
<td>195 (4.1)</td>
<td>15 (8.9)</td>
</tr>
<tr>
<td>Maximum AKI status, n (%)</td>
<td>3337 (74.0)</td>
<td>85 (49.1)</td>
</tr>
<tr>
<td>0</td>
<td>691 (15.3)</td>
<td>27 (15.6)</td>
</tr>
<tr>
<td>1</td>
<td>279 (6.2)</td>
<td>15 (8.67)</td>
</tr>
<tr>
<td>2</td>
<td>203 (4.5)</td>
<td>46 (26.6)</td>
</tr>
<tr>
<td>Severe AKI (Stage 2 or 3)</td>
<td>481 (10.7)</td>
<td>61 (36.4)</td>
</tr>
<tr>
<td>Ventricular assist device, n (%)</td>
<td>7 (0.15)</td>
<td>0 (0)</td>
</tr>
<tr>
<td>ECMO, n (%)</td>
<td>20 (0.4)</td>
<td>6 (3.6)</td>
</tr>
<tr>
<td>RRT, n (%)</td>
<td>49 (1.0)</td>
<td>24 (14.2)</td>
</tr>
<tr>
<td>Mechanical ventilation, n (%)</td>
<td>1456 (30.3)</td>
<td>125 (70.6)</td>
</tr>
<tr>
<td>Vasoactive support, n (%)</td>
<td>618 (12.8)</td>
<td>108 (63.9)</td>
</tr>
</tbody>
</table>

Kaddourah A, Basu RK, Bagshaw SM, Goldstein SL: “Epidemiology of Acute Kidney Injury in Critically Ill Children and Young Adults”
[www.nejm.org](http://www.nejm.org)
Where We Want to Go

ICU Admit

Renal Angina Index Assessment in 1st 12 hours

RAI ≥ 8

RAI < 8

Urine NGAL Assessment

Urine NGAL < 150 ng/ml

Urine NGAL ≥ 500 ng/ml

500 ng/ml > Urine NGAL > 150 ng/ml

Furosemide Stress Test

UOP increases to ≥1 ml/kg/hour for 2 hours

UOP does not increase to ≥1 ml/kg/hour for 2 hours

Fluid Restrict Start RRT at 10-15% ICU Fluid Overload

Continue standard management + diuretics

Daily Urine Sample Collection for Renal Recovery Markers
AWAKEN

24 units
4 countries Australia, Canada, India, US
Jan-March 2014

AKI 585/2162 27%

Jennifer G. Jetton; Louis J. Boohaker; Sidharth K. Sethi
David Askenazi for NKC. Accepted Lancet Child & Adolescent Health
AWAKEN
Neonatal AKI 585/2162 27%

<table>
<thead>
<tr>
<th></th>
<th>Prevalence</th>
<th>Mortality AKI versus no AKI</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>VLBW</td>
<td>18%</td>
<td>55% vs 5%</td>
</tr>
<tr>
<td></td>
<td>40%</td>
<td>14% vs 4%</td>
</tr>
<tr>
<td>ELBW</td>
<td>13%</td>
<td>70% vs 22%</td>
</tr>
<tr>
<td>Sick near term/term</td>
<td>18%</td>
<td>22% vs 0%</td>
</tr>
<tr>
<td>Sepsis</td>
<td>26%</td>
<td>70% vs 25%</td>
</tr>
<tr>
<td>Asphyxiated</td>
<td>38%</td>
<td>73% vs 20%</td>
</tr>
<tr>
<td>ECMO</td>
<td>71%</td>
<td></td>
</tr>
</tbody>
</table>

David Askenazi for NKC.

Accepted *Lancet Child & Adolescent Health* 2017
Red Cross Children’s Hospital(RXH) University of Cape Town Experience

- Increasing incidence in association with multi-organ failure in paediatric ICU’s
- 22 Beds – 29 initially – 39 May 2018
- 1,400 admissions per year
  - Acute medical cases  600/yr
  - Cardiac cases      300/yr
  - Burns             50/yr
  - Head injuries     50/yr
  - Other             Rest
- Mortality 5% predicted 10-12%
- Dialysis 3.5%
## Causes of Acute Kidney Injury

<table>
<thead>
<tr>
<th>Condition</th>
<th>Count</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sepsis</td>
<td>46</td>
<td>22%</td>
</tr>
<tr>
<td>Post-cardiac surgery</td>
<td>36</td>
<td>17%</td>
</tr>
<tr>
<td>Undiagnosed chronic renal disease</td>
<td>21</td>
<td>10%</td>
</tr>
<tr>
<td>Gastroenteritis</td>
<td>19</td>
<td>9%</td>
</tr>
<tr>
<td>Haemolytic uraemic syndrome</td>
<td>19</td>
<td>9%</td>
</tr>
<tr>
<td>Necrotizing enterocolitis</td>
<td>15</td>
<td>7%</td>
</tr>
</tbody>
</table>
## Causes of Acute Kidney Injury

<table>
<thead>
<tr>
<th>Condition</th>
<th>Count (Percentage)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Leukaemia/Lymphoma</td>
<td>14 (6%)</td>
</tr>
<tr>
<td>Myocarditis</td>
<td>11 (5%)</td>
</tr>
<tr>
<td>Rapidly progressive nephritis</td>
<td>10 (5%)</td>
</tr>
<tr>
<td>Trauma/Burns</td>
<td>8 (4%)</td>
</tr>
<tr>
<td>Toxin ingestion</td>
<td>7 (3%)</td>
</tr>
<tr>
<td>Kwashiorkor**</td>
<td>6 (3%)</td>
</tr>
</tbody>
</table>
Diuretics

- Controversial long term outcomes but easier to manage patient with some urine output than anuria
- Furosemide – bolus or infusion
- Aminophylin 1mg/kg/dose 6hrly
AKI: Treatment Modality Selection

Ashita Tolwani, M.D., M.Sc.
University of Alabama at Birmingham

Critical Care Nephrology – Vicenza
June 2015
Which mode of RRT is ‘best’ in the ICU?

RRT MODALITIES

Intermittent
- IHD
- PIRRT

Continuous
- CRRT
- PD
- SCUF
  - CVVH
  - CVVHD
  - CVVHDF

Ashita Tolwani,
New Technology
Infants and young children

Preferred choices for continuous renal replacement therapy (CRRT)

- **Peritoneal dialysis**...but not always possible
- **CVVH**...Not always possible either!
  - Unavailable in low resource settings due to lack of size-appropriate lines and filters
  - Perceived as not possible due to lack of experience
CVVHD/F in Children

- Gaining more experience in Acute HD
  - Better machine suited for children
  - Lines/Circuits /Filters – paeds and neonatal with low priming volumes
  - Haemocatheters difficult to source
    - Acute range to 6.5FR (5Fr Arrow)
    - Internal jugular vessels
  - Acute – metabolic conditions
  - Smallest weight 1.7kg
Complications

- Line access
- Frequent problems were blood pressure related
  - Blood primes
- Clotting circuits
  - Heparin bolus/infusion
  - Fluid boluses
- Skilled and motivated personnel
Controversies

- Citrate/Heparin/Prostacyclin
- Timing of starting...and ending CRRT
- Dialysis dose?
- Survival and Outcomes?
CRRT Machines: Modern Generation
Pediatric patients in the range of 2-10 kgs
(approximate BSA of 0.15–0.5 m²)
Peristaltic pumps with cradle movements instead of the rotors to reduce risk of hemolysis.
# Nidus – Newcastle infant dialysis and ultrafiltration system

<table>
<thead>
<tr>
<th>Feature</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Infants</td>
<td>800g to 8kg</td>
</tr>
<tr>
<td>Treatment Options</td>
<td>CVVHD, SCUF</td>
</tr>
<tr>
<td>Extracorporeal circuit vol</td>
<td>10mls including filter (5ml + stroke volume 5-15ml)</td>
</tr>
<tr>
<td>Filters</td>
<td>High-flux polysulfone 0.045m² hollow fibre haemofilter</td>
</tr>
<tr>
<td>Flow Rates</td>
<td>20-50 ml/min (new version)</td>
</tr>
<tr>
<td>Access</td>
<td>Single Lumen catheters (20g up to 16g; or 6.5-Fr )</td>
</tr>
<tr>
<td>UF accuracy</td>
<td>&lt; 1ml/hr (measured 0.1ml/hr)</td>
</tr>
<tr>
<td>UF capability</td>
<td>0-60mls/hr</td>
</tr>
<tr>
<td>Blood prime</td>
<td>Not required</td>
</tr>
<tr>
<td>Syringes</td>
<td>Disposable; 2 for dialysis, 1 for heparin</td>
</tr>
<tr>
<td>Safety</td>
<td>2 Air detectors</td>
</tr>
<tr>
<td>Safety System pressure monitoring</td>
<td>Monitors withdrawal &amp; return of blood to baby</td>
</tr>
<tr>
<td></td>
<td>Sampling slows if necessary</td>
</tr>
<tr>
<td></td>
<td>Monitors dialysis operating pressures</td>
</tr>
<tr>
<td>Touch screen control</td>
<td>Shows exactly what is happening</td>
</tr>
<tr>
<td></td>
<td>Intuitive clear layout and instructions</td>
</tr>
<tr>
<td>Practicalities</td>
<td>Automatic priming, easy insert tubing, vertical mount, close to bedside, simple layout, minimises spillages &amp; easy clean</td>
</tr>
</tbody>
</table>
International Pediatric Dialysis Survey

Treatment of AKI in developing and developed countries: An international survey of pediatric dialysis modalities

Rupesh Raina¹,²*, Abigail M. Chauvin³, Timothy Bunchman⁴, David Askenazi⁵, Akash Deep⁶, Michael J. Ensley⁷, Vinod Krishnappa², Sidharth Kumar Sethi⁸
Treatment of AKI in developing and developed countries: An international survey of pediatric dialysis modalities.

Raina R¹,², Chauvin AM³, Bunchman T⁴, Askenazi D⁵, Deep A⁶, Ensley MJ⁷, Krishnappa V², Sethi SK⁸.

- 650 Ped Nephls internet survey Dialysis modalities
- 34% response rate
- **PD available in all centres**
- CRRT available
  - 60% Developed & 33.3% Developing
- Infants preferred modality
  - Developed HD 72% CRRT 24%
  - Developing 68.5%
Table 2. Summary of results for RRT in AKI.

<table>
<thead>
<tr>
<th></th>
<th>Developing Countries</th>
<th>Developed Countries</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Availability of pediatric nephrologist</td>
<td>35.4% (17/48)</td>
<td>100% (175/175)</td>
<td>0.000</td>
</tr>
<tr>
<td>Availability of dedicated pediatric dialysis unit</td>
<td>33.3% (16/48)</td>
<td>91% (159/175)</td>
<td>0.000</td>
</tr>
<tr>
<td>Institute’s dialysis modality of choice in infants</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PD</td>
<td>68.5% (33/48)</td>
<td>5.7% (10/175)</td>
<td>0.000</td>
</tr>
<tr>
<td>HD</td>
<td>12.5% (6/48)</td>
<td>72% (126/175)</td>
<td>0.000</td>
</tr>
<tr>
<td>CRRT</td>
<td>10.4% (5/48)</td>
<td>24% (42/175)</td>
<td>0.041</td>
</tr>
<tr>
<td>SLED</td>
<td>8.3% (4/48)</td>
<td>1.1% (2/175)</td>
<td>0.006</td>
</tr>
<tr>
<td>Institute’s dialysis modality of choice in older children (&gt;12 years old)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PD</td>
<td>29.1% (14/48)</td>
<td>22.2% (39/175)</td>
<td>0.319</td>
</tr>
<tr>
<td>HD</td>
<td>64.5% (31/48)</td>
<td>61.1% (107/175)</td>
<td>0.668</td>
</tr>
<tr>
<td>CRRT</td>
<td>2% (1/48)</td>
<td>14.8% (28/175)</td>
<td>0.016</td>
</tr>
<tr>
<td>SLED</td>
<td>2% (1/48)</td>
<td>2.2% (4/175)</td>
<td>0.933</td>
</tr>
<tr>
<td>Availability of RRT’s</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PD</td>
<td>100% (48/48)</td>
<td>100% (175/175)</td>
<td>1</td>
</tr>
<tr>
<td>HD</td>
<td>54.1% (26/48)</td>
<td>85.1% (149/175)</td>
<td>0.000</td>
</tr>
<tr>
<td>CRRT</td>
<td>33.3% (16/48)</td>
<td>60% (105/175)</td>
<td>0.001</td>
</tr>
<tr>
<td>SLED</td>
<td>25% (12/48)</td>
<td>20% (35/175)</td>
<td>0.452</td>
</tr>
</tbody>
</table>
Which mode of RRT is 'best' in the ICU?
24 studies identified

19/24 from Asia, Africa, and South America

13 studies with PD only

11 studies with PD and EBP

- 7 observational
- 4 randomized

PD Techniques

- Automated machines
  - Home choice/Sleep safe
Practicalities of PD

- **Prescription**
  - Start off with 10-20ml/kg fluid per exchange
  - Adapted to ventilatory requirements

- **Dialysis fluid**
  - Lactate buffered – Dianeal or
  - Bicarbonate based - Bicavera
  - Weak 1.5%/Medium 2.5%/Strong 4.25%
  - ‘Home-made solutions’ – Ringers and 50% Dextrose

- **Cycles: Fill/Dwell/Drain**
  - 10/30-90/20mins
PD Fluid Prescription

Adjustments
- Fluid overload – increase sugar solution
- Solute removal eg. K+ - increase frequency of cycle (Ensure K+ free solution)

Additives
- Heparin 500-1000u/litre
- Antibiotics ?

Neonates /liver failure – better to use bicarbonate based solution
- Lactate based fluids may confuse lactate reading on gas
New Generation Cook Catheters

Use of the Multipurpose Drainage Catheter for the Provision of Acute Peritoneal Dialysis in Infants and Children

Ari Auron, MD,¹ Bradley A. Warady, MD,¹ Steve Simon, PhD,² Douglas L. Blowey, MD,¹ Tarak Srivastava, MD,¹ Gulam Musharaf, MD,¹ and Uri S. Alon, MD¹

Figure 1. CMMDC. (Top) Mac-Loc mechanism, (center) distal fenestrations, and (bottom) distal catheter coiling. (Reprinted with permission from Cook Inc, Bloomington, IN).
Kimal ‘Peel-away’ Tenckhoff
Automated Dialysis Home choice machine
Manual Dialysis with Fluid Warmer
IPNA/ISN Training for Africa

Nigeria

Kenya

Nigeria

Benin

Ghana

Uganda
Challenges on Return

- Poor Staffing 100%
- Lack of Facilities & Equipment 86%
- Radiology – Ultrasound only 86%
- Support from Home Institutions 71%
- Histology support 57%
• Prospective, Observational
• 41 countries
• 2014
• >350 children
The Saving Young Lives project

A partnership to deliver care of Acute Kidney Injury in low resource settings

Have we succeeded?
Current SYL Sites
Training Teams of People

• Including Nurses – ‘1 Doctor and 1-2 Nurses’
• Total 148 trained Acute Renal Skills
  – 47 Teams of Doctors and Nurses
  – All parts of Africa – including some French areas
Surgical Support
Learning is fun!
Doctor Nurse Teams

Bloemfontein, SA

Ghana

Malawi + Zambia

Kenya

Nigeria
Adult Team 😊

‘BRETT BELLY’
Equipment

• PD catheters – bedside insertion
  – Infants – problem – Cook multipurpose catheters
  – Older children and Adults – PD catheters with Seldinger insertion kits – Mexican, Kimal, Covidien, Arrow

• Fluid
  – “Home-made”
  – Ringers Lactate and 50% Dextrose
ISPD GUIDELINES/RECOMMENDATIONS

PERITONEAL DIALYSIS FOR ACUTE KIDNEY INJURY

Brett Cullis,1,2 Mohamed Abdelraheem,3 Georgi Abrahams,4 Andre Balbi,5 Dinna N. Cruz,6 Yaacov Frishberg,7 Vera Koch,8 Mignon McCulloch,9 Alp Numanoglu,10 Peter Nourse,9 Roberto Pecoits-Filho,11 Daniela Ponce,5 Bradley Warady,12 Karen Yeates,13 and Fredric O. Finkelstein14
Training and Education

SYL faculty teaching catheter insertion methods to a group of 40 delegates from West Africa, Yaoundé, March 2017
Advocacy

SYL delegation meeting with the Cameroon Minister of Health to advocate for free treatment of PD, March 2017, Yaoundé
Acute kidney disease and renal recovery: consensus report of the Acute Disease Quality Initiative (ADQI) 16 Workgroup

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Chawla LS¹, Bellomo R², Bihorac A³, Goldstein SL⁴, Siew ED⁵, Bagshaw SM⁶, Bittleman D⁷, Cruz D⁸, Endre Z⁹, Fitzgerald RL⁷, Forni L¹⁰, Kane-Gill SL¹¹, Hoste E¹², Koyner J¹³, Liu KD¹⁴, Macedo E⁸, Mehta R⁸, Murray P¹⁵, Nadim M¹⁶, Ostermann M¹⁷, Palevsky PM¹⁸,¹⁹, Pannu N⁶, Rosner M²⁰, Wald R²¹, Zarbock A²², Ronco C²³, Kellum JA²⁴; Acute Disease Quality Initiative Workgroup 16.

Figure 1 | Acute kidney injury and chronic kidney disease. Acute kidney injury and chronic kidney disease often form a continuum of disease as opposed to being separate entities. The various disease modifiers and risk factors might represent opportunities to intervene and mitigate the poor outcomes associated with these diseases. Modified from Acute Dialysis Quality Initiative 16; www.adqi.org.
Figure 2 | The continuum of acute kidney injury (AKI), acute kidney disease (AKD) and chronic kidney disease (CKD). AKI, AKD and CKD can form a continuum whereby
Injury

- Up to 7 days
  - AKI KDIGO stage
    - Ongoing RRT
    - 3 (SCr 3x)/RRT
    - 2 (SCr 2x)
    - 1 (SCr 1.5x)
    - Subacute AKI

- 7–90 days
  - AKD stage (congruent to AKI stage)
    - Ongoing RRT
    - 3 (SCr 3x)/RRT
    - 2 (SCr 2x)
    - 1 (SCr 1.5x)
    - 0 Subacute AKD

- >90 days
  - CKD

Stage 0 subtypes
- C: SCr not back to baseline
- B: Biomarker or loss of renal reserve indicates injury
- A: No evidence of injury
Figure 5 | A layered approach to the follow-up of patients with acute kidney disease (AKD). The severity of AKD should determine the frequency and intensity of follow-up care. Patients with more severe AKD should receive nephrology follow-up if feasible. Key
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The future of critical care: renal support in 2027

William R. Clark¹, Mauro Neri², Francesco Garzotto², Zaccaria Ricci³, Stuart L. Goldstein⁴, Xiaqiang Ding⁵, Jiarui Xu⁵,⁶ and Claudio Ronco²,⁷

- Precision CRRT/Dynamic CRRT
- Inline sensors for urea nitrogen measurement
- Timing of initiation – demand/capacity imbalance
- Clinical application of biomarkers
- Fluid overload – FO% initiation for CRRT
- Regional Citrate anti-coagulation and anti-thrombogenic membranes
Overall recommendations: Critically ill patient with AKI

- Caution with fluid resuscitation
- Early consultation and assessment of %FO
  - Early initiation of CRRT + Inotropes over fluid administration to maintain BP
- Appropriate expertise in management of RRT
  - *DO what you are good at!*
  - *Do not delay*
  - *Call a friend*
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