ACUTE KIDNEY INJURY FOLLOW UP

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EMEESY Network Meeting 10/10/14


WHERE?
WHAT?
WHO?
HOW?
WHY?
WHEN?

Definition

- *Creatinine rise >26mmol/L within 48 hours*
- >50% rise in creatinine over proceeding 7 days
- Urine output <0.5ml/Kg/hr over 8 hours
- >25% fall in eGFR over proceeding 7 days

Table 6. Pediatric-modified RIFLE (pRIFLE) criteria

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	Estimated CCl	Urine output
Risk	eCCl decrease by 25%	<0.5 ml/kg/h for 8 h
Injury	eCCl decrease by 50%	<0.5 ml/kg/h for 16 h
Failure	eCCl decrease by 75% or eCCl <35 ml/min/1.73 m^2	<0.3 ml/kg/h for 24 h or anuric for 12 h
Loss	Persistent failure >4 weeks	
End stage	End-stage renal disease (persistent failure >3 months)	

eCCl, estimated creatinine clearance; pRIFLE, pediatric risk, injury, failure, loss and end-stage renal disease.

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KIDNEY DISEASE · IMPROVING GLOBAL OUTCOMES · KDIGO

Acute Kidney Injury Network · AKIN

Some NICE Guidance

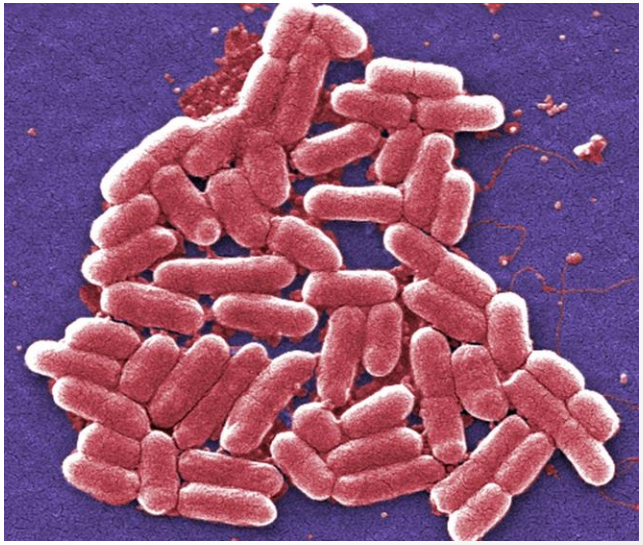
- 1.5.16 Monitor[7] serum creatinine after an episode of acute kidney injury. Consider referral to a nephrologist or paediatric nephrologist when eGFR is 30 ml/min/1.73 m^2 or less in adults, children and young people who have recovered from an acute kidney injury

- 1.5.17 Consider referral to a paediatric nephrologist for children and young people who have recovered from an episode of acute kidney injury but have hypertension, impaired renal function or 1+ or greater proteinuria on dipstick testing of an early morning urine sample

- [7] The frequency of monitoring should be based on the stability and degree of renal function at the time of discharge.

So Why Follow Up?

- AKI does progress to CKD
  - Special cases, HUS.
- JAMA. 2003 Sep 10;290(10):1360-70.
- *Long-term renal prognosis of diarrhea-associated hemolytic uremic syndrome: a systematic review, meta-analysis, and meta-regression.*
- Garg AX[1], Suri RS, Barrowman N, Rehman F, Matsell D, Rosas-Arellano MP, Salvadori M, Haynes RB, Clark WF.
  - 25% of survivors demonstrate long-term renal sequelae (>3400 pts in study)

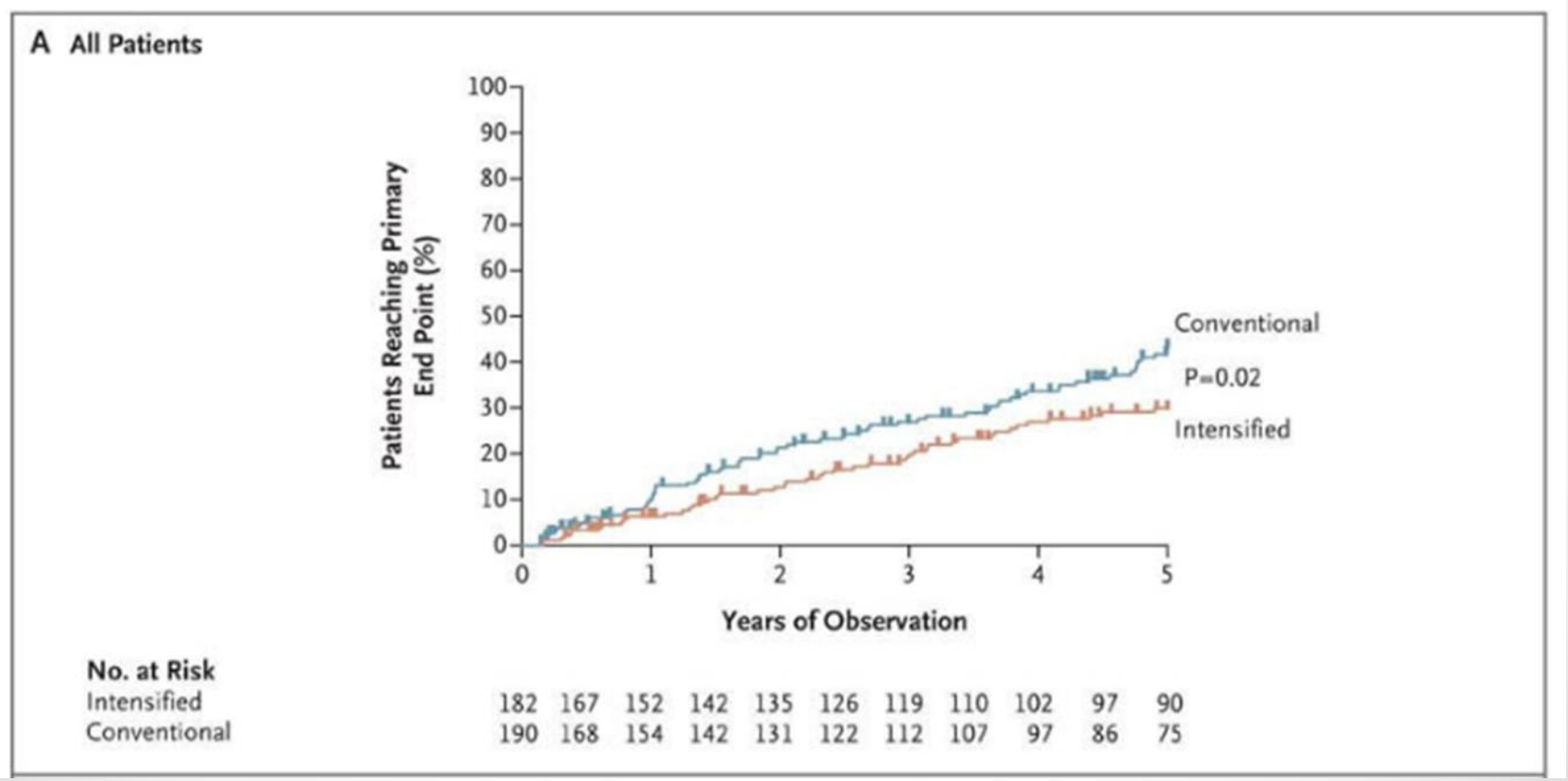


So Why Follow Up

- And the rest?
  - Less clear
    - Epidemiology may give a clue (more secondary causes of AKI and thus CKD)
    - New Biomarkers may help tracking AKI to CKD e.g.Neutrophil gelatinase-associated lipocalin (NGAL), Kidney Injury Molecule 1 (KIM 1), Liver Type Fatty acid binding protein (L-FABP)
    - Viaud et al:- 2/3 of those with severe AKI had evidence of renal injury (all cause) at 12 years (received RRT) (13 pts)
    - Mammen et al:- 10% of all AKI admitted to PICU had CKD at 3 years (126 pts)
    - Preterm infants may be even more significantly affected

Why to follow (2)

- CKD is a progressive but modifiable disease



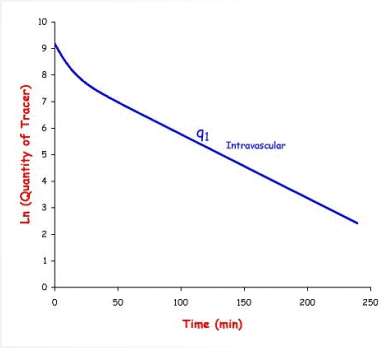
50% reduction in GFR, GFR <10 ml/min/1.73 or RRT

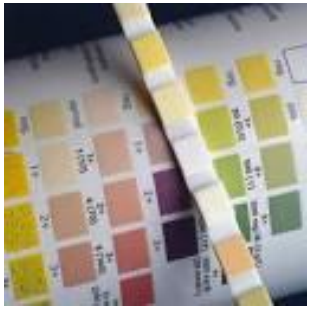
Who to follow?

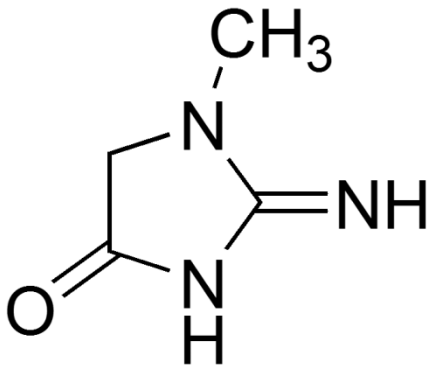
- All patients with significant AKI
  - Can probably exclude those with rapidly resolving pre-renal causes
- Certainly all who received RRT

	Serum Creatinine	Urine Output
Stage 1	eGFR < 75 ml/min/1.73m^2 *Or* decrease in eGFR by 25% *Or* increase creatinine 1.5 – 2 x baseline	<0.5 ml/kg/hr for 6 hours
Stage 2	eGFR < 50 ml/min/1.73m^2 *Or* decrease in eGFR by 50% *Or* increase creatinine 2 – 3 x baseline	<0.5 ml/kg/hr for 12 hours
Stage 3	eGFR <35 ml/min/1.73m^2 *Or* decrease in eGFR by 75% *Or* increase in creatinine > 3 x baseline *Or* requirement for renal replacement therapy	<0.3 ml/kg/hr for 24 hours *Or* anuria for 12 hours

How to follow?







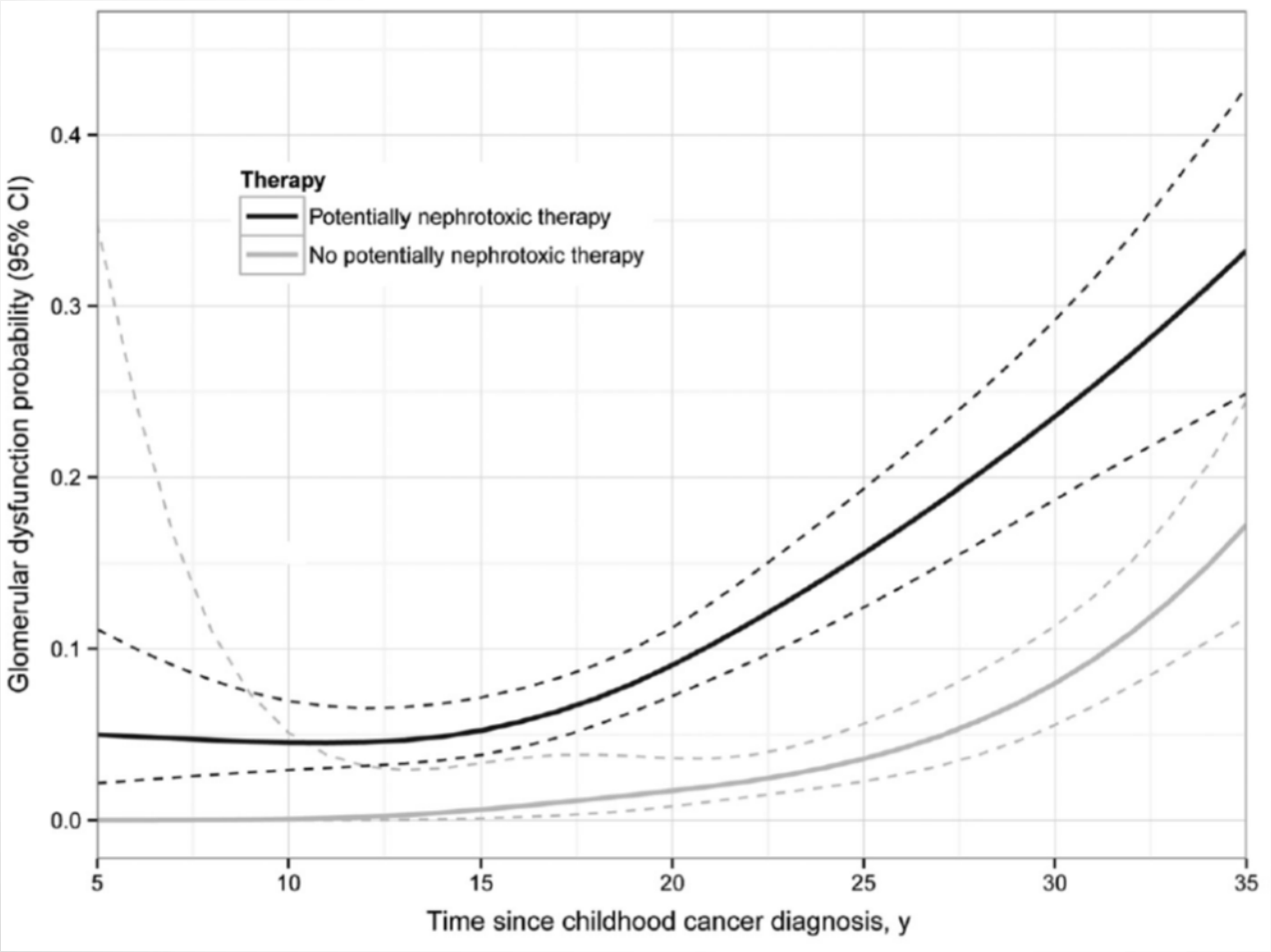
For the less visual learners…

- Creatinine check year 1and year 5
- Annual BP check
- Annual urine dip or protein : creatinine ratio
- Formal GFR (for those who received RRT and those with HUS) at 1 yr, 5 yrs and post puberty.

Special Cases -Oncology

- Ifosphamide and platinum chemotherapy
  - Both effect glomerular function (AKI and CKD)
  - Both effect tubular function
- Some effects may resolve
  - E.g. tubular effects of ifosphamide
- Others persist
  - E.g. tubular effects of cisplatin or glomerular dysfunction
- Follow up therefore involves
  - Urine dip / PCR
  - Assessment of tubular function, phosphate, bicarbonate etc
  - Creatinine
  - Blood pressure
- Risk factors alone (high cumulative dose, single kidney) will not predict all cases of ongoing kidney disease

Mulder et al. Cancer Epidemiol Biomarkers Prev 2013; 22: 1736-1746



Likelihood of GFR <90 at 35 years

- 26.4% if potentially nephrotoxic treatment received
- 6.6% if no nephrotoxic treatment

($p<0.001$)

Special cases -Neonates

- 20 Neonates <1000g with AKI (rise in creat >48 hrs or U/O <0.5ml/kg/hr) 18 year review
- Mean age 7.5 yrs
- 9 GFR <75ml/min/1.73m^2.
- Predictors for CKD
  - P:CR at 1 year
  - Serum creatinine at 1 year
- How to follow?
  - Urine dip
  - Creatinine
  - Blood pressure

Carolyn L. Abitbol · Charles R. Bauer
Brenda Montané · Jayanthi Chandar
Shahnaz Duara · Gastón Zilleruelo

Long-term follow-up of extremely low birth weight infants with neonatal renal failure

References

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- NICE (2013) *Acute kidney injury: prevention, detection and management of acute kidney injury up to the point of renal replcaement therapy.*
- KDIGO (2012) *Clinical Practice Guidelines for Acute Kidney Injury.*

EMEESY

Network Follow up

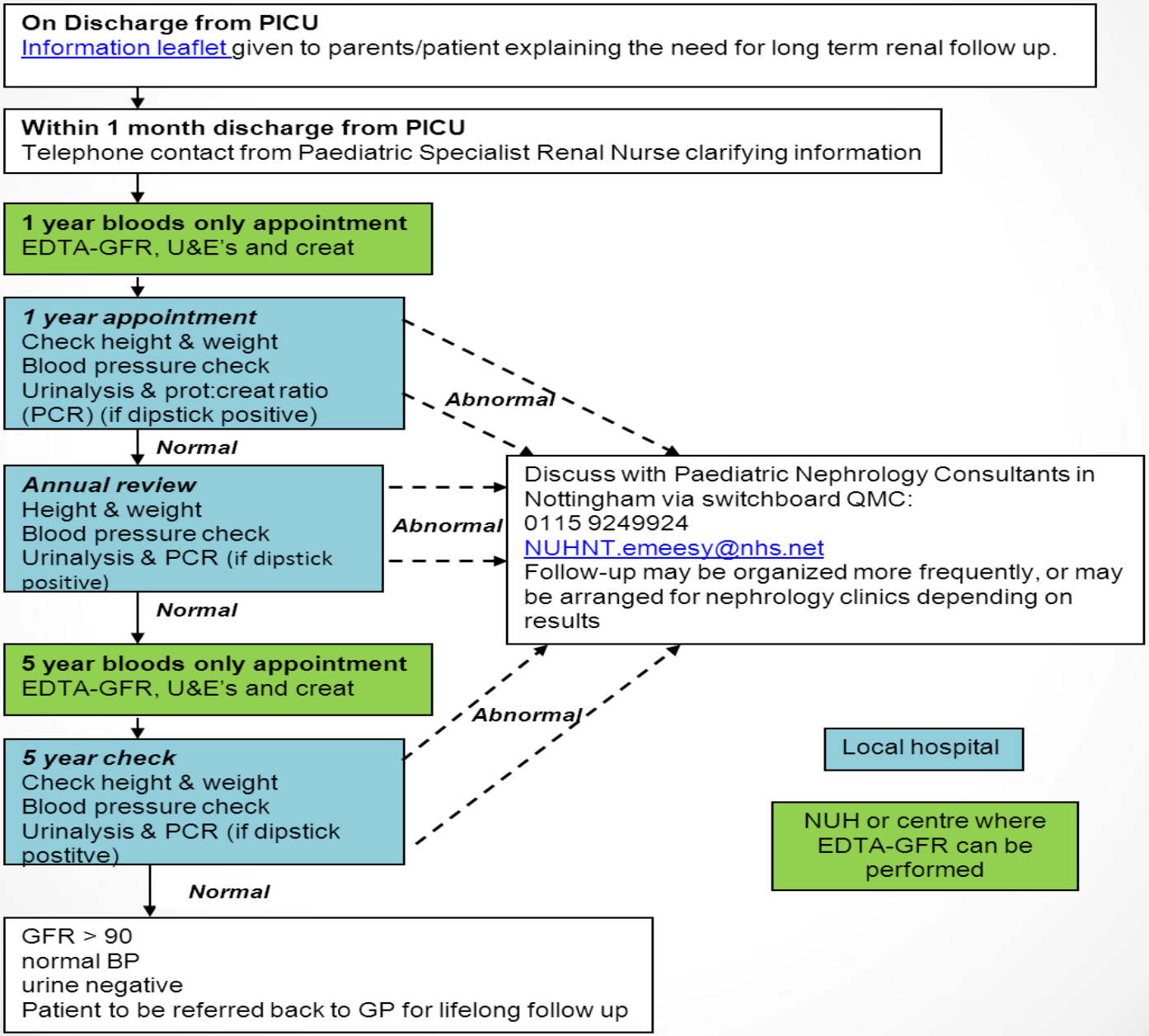
Molly McLaughlin

Paediatric Renal Critical Care Nurse

Background

- Historically: no defined pathway for follow up
- January 2014: AKI follow up introduced for all patients having CRRT within PICU
- Initially 5 year follow up, now extended to lifelong
- Plan to widen this to all AKI(level 3, persistent, all receiving RRT)

Protocol for Follow-up of patients discharged home following Renal Replacement Therapy for AKI (CVVH/PD)



Referrals to date

- 16 patients identified since January for follow up within EMEESY PICUs
  - Sheffield 4
    - 2 SCH
    - 1 Doncaster
    - 1 Rotherham (currently being seen at SCH)
  - Nottingham 5
    - 3 NUH
    - 1 Kettering
    - 1 Cambridge
  - Leicester (LRI/GH) 7
    - 3 NUH
    - 2 UHL
    - 1 Kettering
    - 1 Boston

Potential challenges

- Identifying patients & ensuring initial referral proving problematic
- Referral pathway
  - Do all patients come under a Nephrologist at NUH?
  - Bloods only appointment in other centre
- Follow up of all AKI