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Abbreviations:

AKI – Acute Kidney Injury

GFR - Glomerular Filtration Rate

EMEESY - East Midlands, East of England and South Yorkshire Children’s Kidney Network

eGFR - estimated Glomerular Filtration Rate

NUH – Nottingham University Hospitals

UHL – University Hospitals of Leicester

UTI – Urinary Tract Infection

VUR – Vesicoureteral Reflux

Scope

Children not known to paediatric nephrology services with estimated GFR < 90 ml/min/1.73m²

This guideline applies to Children and young people under 18 years of age with abnormal Glomerular Filtration Rate (GFR) within the EMEESY Children’s Kidney Network (East Midlands, East of England and South Yorkshire) being managed by the Leicester Children’s Hospital and the Paediatric Emergency Department.

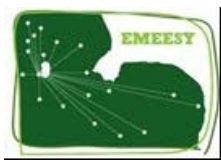
This EMEESY network guideline has been developed by clinicians from Nottingham Children’s Renal Unit with consultation across the network including from the Leicester Royal Infirmary and has been ratified by the Leicester Children’s Hospital guideline process.

Rationale

Creatinine is an insensitive method of identifying impaired renal function in children.

GFR should be estimated (eGFR) whenever a creatinine result is checked.

Automated reporting is now available for in-patients in Nottingham aged 2 – 16 years of age.



If the automated reporting is not available for blood samples processed in NUH NHS Trust the following formula should be used;

$$\text{eGFR (ml/min/1.73m}^2\text{)} = k \times \text{height (cm)} / \text{serum creatinine (}\mu\text{mol/l)}$$

In UHL k = 40 for both sexes and all age groups.

(NUH k = 36 in males ≥ 13 years of age and k = 30 in all other cases).

An eGFR of less than 90 ml/min/1.73m² requires further clinical evaluation.

Assessment

All children with an eGFR < 90 ml/min/1.73m² need further evaluation. This is however an estimate and further investigations need to be considered in the light of the clinical context.

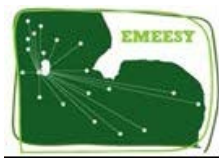
Assessment should include in all children

- Clinical review for signs / symptoms of acute kidney injury – if present will need same day referral to hospital (see Paediatric AKI guideline)
- Clinical review for signs / symptoms of nephrotic syndrome – if present will need same day referral to hospital (see Paediatric Nephrotic Syndrome guideline)
- blood pressure with reference to appropriate centile chart (See appendix)
- urine dipstick for protein and an early morning urine for Albumin : Creatinine ratio if dipstick positive or if eGFR is < 80 ml/min/1.73m² even if dipstick is negative.

In children with an estimate ≥ 80 ml/min/1.73m² with normal blood pressure, no proteinuria and no risk factors this can be considered as normal and no further investigations are required.

Risk factors include;

- Hypertension
- Proteinuria
- Drug history for nephrotoxic drugs e.g. NSAID, aminoglycosides
- History of UTI
- Family History of UTI, VUR or renal disease
- Past Medical History of AKI or conditions associated with AKI e.g. prematurity, treated with chemotherapy, methotrexate etc.



Referral

Referral should be to a consultant paediatric nephrologist. Urgent referrals should be via the on-call paediatric nephrology consultant available switchboard
Urgency of referral is based on eGFR and risk factors.

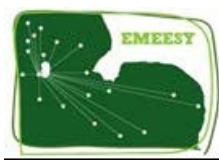
eGFR (ml/min/1.73m ²)	No Risk Factors	One or more risk factors
Consider earlier referral / discussion if signs of AKI, symptoms, significant hypertension or nephrotic range proteinuria at all levels of eGFR.		
80-89	<ul style="list-style-type: none"> if no proteinuria, no hypertension and no risk factors then can be considered normal. 	<ul style="list-style-type: none"> consider stopping nephrotoxic drugs repeat serum creatinine in 4-8 weeks discuss with paediatric nephrology if repeat confirms eGFR < 90 ml/min/1.73m²
60-79	<ul style="list-style-type: none"> repeat serum creatinine in 4-8 weeks if persistently < 80 ml/min/1.73m² <ul style="list-style-type: none"> routine referral to paediatric nephrology 	<ul style="list-style-type: none"> stop nephrotoxic drugs consider renal USS routine referral to paediatric nephrology repeat serum creatinine in 4-8 weeks
30-59	<ul style="list-style-type: none"> arrange renal USS routine referral to paediatric nephrology 	<ul style="list-style-type: none"> stop nephrotoxic drugs arrange renal USS telephone referral to paediatric nephrology
<30	<ul style="list-style-type: none"> stop nephrotoxic drugs same day referral to paediatric nephrology 	

Audit - The following should be audited

- 1) Number of patients referred according to criteria
- 2) Number of patients referred who did not meet criteria
- 3) Number of patients who were referred later than suggested by criteria

Key Words

Creatinine, Nephrology, Renal

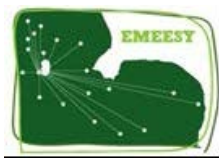


The Trust recognises the diversity of the local community it serves. Our aim therefore is to provide a safe environment free from discrimination and treat all individuals fairly with dignity and appropriately according to their needs. As part of its development, this policy and its impact on equality have been reviewed and no detriment was identified.

Contact & review details	
Guideline Lead (Name and Title) A Hall – Associate Specialist	Executive Lead Chief Medical Officer
Details of Changes made during review: Amended eGFR formula in line with local guidance Placed in local template Added keywords	

Title of Guideline	Guideline for the assessment and referral of children with an estimated GFR less than 90 ml/min/1.73m ²														
Contact Name and Job Title (author)	Dr A Lunn, Consultant Paediatric Nephrologist,														
Directorate & Speciality	Family Health Speciality: Renal														
Date of submission	March 2020														
Date on which guideline must be reviewed (this should be one to three years)	December 2021														
Version	2285														
Explicit definition of patient group to which it applies (e.g. inclusion and exclusion criteria, diagnosis)	Children and young people under 18 years of age with abnormal GFR														
Abstract	This guideline describes the assessment and management of children and young people in whom a creatinine based estimate of their GFR is abnormal i.e. less than 90 ml/min/1.73m ²														
Key Words	Paediatric, Child, young person, renal, GFR														
Statement of the evidence base of the guideline – has the guideline been peer reviewed by colleagues? Evidence base: (1-5)	Up to 4														
<table border="1"> <tbody> <tr> <td>1a</td> <td>meta analysis of randomised controlled trials</td> </tr> <tr> <td>1b</td> <td>at least one randomised controlled trial</td> </tr> <tr> <td>2a</td> <td>at least one well-designed controlled study without randomisation</td> </tr> <tr> <td>2b</td> <td>at least one other type of well-designed quasi-experimental study</td> </tr> <tr> <td>3</td> <td>well –designed non-experimental descriptive studies (ie comparative / correlation and case studies)</td> </tr> <tr> <td>4</td> <td>expert committee reports or opinions and / or clinical experiences of respected authorities</td> </tr> <tr> <td>5</td> <td>recommended best practise based on the clinical experience of the guideline developer</td> </tr> </tbody> </table>	1a	meta analysis of randomised controlled trials	1b	at least one randomised controlled trial	2a	at least one well-designed controlled study without randomisation	2b	at least one other type of well-designed quasi-experimental study	3	well –designed non-experimental descriptive studies (ie comparative / correlation and case studies)	4	expert committee reports or opinions and / or clinical experiences of respected authorities	5	recommended best practise based on the clinical experience of the guideline developer	
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5	recommended best practise based on the clinical experience of the guideline developer														
Consultation Process	Paediatric Nephrologists, Staff of Nottingham Children's Hospital via the guideline email process														
Target audience	Clinicians and healthcare professionals within Nottingham Children's Hospital and throughout the East Midlands, East of England and South Yorkshire caring for children and young people.														

This guideline has been registered with the trust. However, clinical guidelines are guidelines only. The interpretation and application of clinical guidelines will remain the responsibility of the individual clinician. If in doubt contact a senior colleague or expert. Caution is advised when using guidelines after the review date.



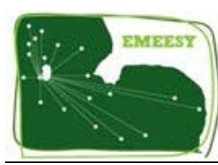
Document Control

Document Amendment Record

Version	Issue Date	Author
V1	July 2014	Andy Lunn Consultant Paediatric Nephrologist
V2	Jan 2017	Andy Lunn Consultant Paediatric Nephrologist
V3	Jan 2020	Andy Lunn Consultant Paediatric Nephrologist

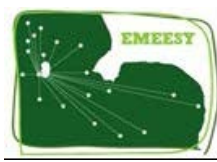
Summary of changes for new version:

1. Contents table and addition of regional network logo



Appendix – Reference ranges for blood pressure in children

Age	BP centile	Boys - Height Centile													
		SBP							DBP						
		5%	10%	25%	50%	75%	90%	95%	5%	10%	25%	50%	75%	90%	95%
1	50 th	85	85	86	86	87	88	88	40	40	40	41	41	42	42
	90 th	98	99	99	100	100	101	101	52	52	53	53	54	54	54
	95 th	102	102	103	103	104	105	105	54	54	55	55	56	57	57
	95 th +12	114	114	115	115	116	117	117	66	66	67	67	68	69	69
2	50 th	87	87	88	89	89	90	91	43	43	44	44	45	46	46
	90 th	100	100	101	102	103	103	104	55	55	56	56	57	58	58
	95 th	104	105	105	106	107	107	108	57	58	58	59	60	61	61
	95 th +12	116	117	117	118	119	119	120	69	70	70	71	72	73	73
3	50 th	88	89	89	90	91	92	92	45	46	46	47	48	49	49
	90 th	101	102	102	103	104	105	105	58	58	59	59	60	61	61
	95 th	106	106	107	107	108	109	109	60	61	61	62	63	64	64
	95 th +12	118	118	119	119	120	121	121	72	73	73	74	75	76	76
4	50 th	90	90	91	92	93	94	94	48	49	49	50	51	52	52
	90 th	102	103	104	105	105	106	107	60	61	62	62	63	64	64
	95 th	107	107	108	108	109	110	110	63	64	65	66	67	67	68
	95 th +12	119	119	120	120	121	122	122	75	76	77	78	79	79	80
5	50 th	91	92	93	94	95	96	96	51	51	52	53	54	55	55
	90 th	103	104	105	106	107	108	108	63	64	65	65	66	67	67
	95 th	107	108	109	109	110	111	112	66	67	68	69	70	70	71
	95 th +12	119	120	121	121	122	123	124	78	79	80	81	82	82	83
6	50 th	93	93	94	95	96	97	98	54	54	55	56	57	57	58
	90 th	105	105	106	107	109	110	110	66	66	67	68	68	69	69
	95 th	108	109	110	111	112	113	114	69	70	70	71	72	72	73
	95 th +12	120	121	122	123	124	125	126	81	82	82	83	84	84	85
7	50 th	94	94	95	97	98	98	99	56	56	57	58	58	59	59
	90 th	106	107	108	109	110	111	111	68	68	69	70	70	71	71
	95 th	110	110	111	112	114	115	116	71	71	72	73	73	74	74
	95 th +12	122	122	123	124	126	127	128	83	83	84	85	85	86	86
8	50 th	95	96	97	98	99	99	100	57	57	58	59	59	60	60
	90 th	107	108	109	110	111	112	112	69	70	70	71	72	72	73
	95 th	111	112	112	114	115	116	117	72	73	73	74	75	75	75
	95 th +12	123	124	124	126	127	128	129	84	85	85	86	87	87	87
9	50 th	96	97	98	99	100	101	101	57	58	59	60	61	62	62
	90 th	107	108	109	110	111	112	113	70	71	72	73	74	74	74
	95 th	112	112	113	115	116	118	119	74	74	75	76	76	77	77
	95 th +12	124	124	125	127	128	130	131	86	86	87	88	88	89	89
10	50 th	97	98	99	100	101	102	103	59	60	61	62	63	63	64
	90 th	108	109	11	112	113	115	116	72	73	74	74	75	75	76
	95 th	112	113	114	116	118	120	121	76	76	77	77	78	78	78
	95 th +12	124	125	126	128	130	132	133	88	88	89	89	90	90	90
11	50 th	99	99	101	102	103	104	106	61	61	62	63	63	63	63
	90 th	110	111	112	114	116	117	118	74	74	75	75	75	76	76
	95 th	114	114	116	118	120	123	124	77	78	78	78	78	78	78
	95 th +12	126	126	128	130	132	135	136	89	90	90	90	90	90	90
12	50 th	101	101	102	104	106	108	109	61	62	63	63	63	63	63
	90 th	113	114	115	117	119	121	122	75	75	75	75	75	76	76
	95 th	116	117	118	121	124	126	128	78	78	78	78	78	79	79
	95 th +12	128	129	130	133	136	138	140	90	90	90	90	90	91	91
13	50 th	103	104	105	108	110	111	112	61	60	61	62	63	64	65
	90 th	115	116	118	12	124	126	126	74	74	74	75	76	77	77
	95 th	119	120	122	125	128	130	131	78	78	78	78	80	81	81
	95 th +12	131	132	134	137	140	142	143	90	90	90	90	92	93	93
14	50 th	105	106	109	111	112	133	133	60	60	62	64	65	66	67
	90 th	119	120	123	126	127	128	129	74	74	75	77	78	79	80
	95 th	123	125	127	130	132	133	134	77	78	79	81	82	83	84
	95 th +12	135	137	139	142	144	145	146	89	90	91	93	94	95	96
15	50 th	108	110	112	113	114	114	114	61	62	64	65	66	67	68
	90 th	123	124	126	128	129	130	130	75	76	78	79	80	81	81
	95 th	127	129	131	132	134	135	135	78	79	81	83	84	85	85
	95 th +12	139	141	143	144	146	147	147	90	91	93	95	96	97	97
16	50 th	111	112	114	115	115	116	116	63	64	66	67	68	69	69
	90 th	126	127	128	129	131	131	132	77	78	79	80	81	82	82
	95 th	130	131	133	134	135	136	137	80	81	83	84	85	86	86
	95 th +12	142	143	145	146	147	148	149	92	93	95	96	97	98	98
17	50 th	114	115	116	117	117	118	118	65	66	67	68	69	70	70
	90 th	128	129	130	131	132	133	134	78	79	80	81	82	82	83
	95 th	132	133	134	135	137	138	138	81	82	84	85	86	86	87
	95 th +12	144	145	146	147	149	150	150	93	94	96	97	98	98	99



Age	BP centile	Girls - Height Centile													
		SBP							DBP						
		5%	10%	25%	50%	75%	90%	95%	5%	10%	25%	50%	75%	90%	95%
1	50 th	84	85	86	86	87	88	88	41	42	42	43	44	45	46
	90 th	98	99	99	100	101	102	102	54	55	55	56	57	58	58
	95 th	101	102	102	103	104	105	105	59	59	60	60	61	62	62
	95 th +12	113	114	114	115	116	117	117	71	71	72	72	73	74	74
2	50 th	87	87	88	89	90	91	91	45	46	47	48	49	50	51
	90 th	101	101	102	103	104	105	106	58	58	59	60	61	62	62
	95 th	104	105	106	106	107	108	109	62	63	63	64	65	66	66
	95 th +12	116	117	118	118	119	120	121	74	75	75	76	77	78	78
3	50 th	88	89	89	90	91	92	93	48	48	49	50	51	53	53
	90 th	102	103	104	104	105	106	107	60	61	61	62	63	64	65
	95 th	106	106	107	108	109	110	110	64	65	65	66	67	68	69
	95 th +12	118	118	119	120	121	122	122	76	77	77	78	79	80	81
4	50 th	89	90	91	92	93	94	94	50	51	51	53	54	55	55
	90 th	103	104	105	106	107	108	108	62	63	64	65	66	67	67
	95 th	107	108	109	109	110	111	112	66	67	68	69	70	70	71
	95 th +12	119	120	121	121	122	123	124	78	79	80	81	82	82	83
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