THE LANCET Child & Adolescent Health

Supplementary appendix

This appendix formed part of the original submission and has been peer reviewed. We post it as supplied by the authors.

Supplement to: Stewart DJ, Hartley JC, Johnson M, Marks SD, du Pré P, Stojanovic J. Renal dysfunction in hospitalised children with COVID-19. *Lancet Child Adolesc Health* 2020; published online June 15. http://dx.doi.org/10.1016/S2352-4642(20)30178-4.

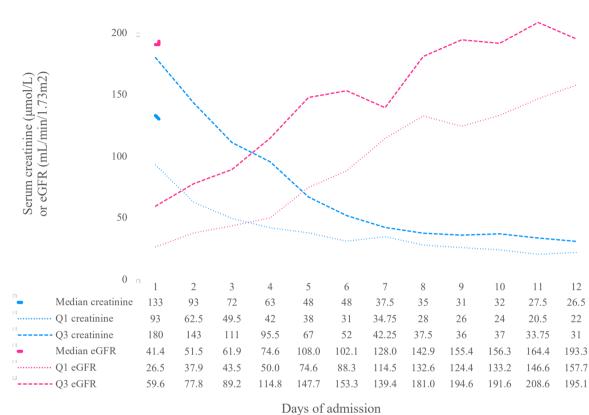
Table – Demographics, clinical features, disease acuity, and markers of renal involvement in children and adolescents with COVID-19

Median age, years 9.4 (5.6-12-9) 9 (7.7-10-5)		All patients (n=52)	Patients with AKI (n=15)
Male 35 (67%) 10 (67%)	Demographics		
Male 35 (67%) 10 (67%) Underlying comorbidities 29 (56%) 4 (27%)* On immunosupressive medication(s) 5 (10%) 0 COVID-19 Clinical features at presentation Fever 46 (88%) 13 (87%) Abdominal pain 24 (46%) 7 (47%) Diarrhoca 22 (42%) 11 (73%) Cough 15 (29%) 1 (7%) Increased work of breathing 23 (44%) 10 (67%) Vomiting 27 (52%) 10 (67%) Rhinitis 5 (10%) 0 Disease acuity PICU admission 37 (71%) 14 (93%) Median duration of PICU stay, days** 3 (2-3) 3.5 (2-5) Mechanical ventilation 24 (46%) 10 (67%) Inotropic support 26 (50%) 13 (87%) ECMO 1 (2%) 0 Multisystem inflammatory syndrome / PIMS-TS 24 (46%) 11 (73%) Markers of renal involvement 10 (19%) [range 37-114 μmol/L] ** Creatinine >1-5 x ULRI 7 (13%) [range 63-148 μmol/L] 7 (47%) <td>Median age, years</td> <td>9.4 (5.6-12.9)</td> <td>9 (7.7-10-5)</td>	Median age, years	9.4 (5.6-12.9)	9 (7.7-10-5)
Underlying comorbidities 29 (56%) 4 (27%)* On immunosuppressive medication(s) 5 (10%) 0 COVID-19 Clinical features at presentation Fever 46 (88%) 13 (87%) Abdominal pain 24 (46%) 7 (47%) Diarrhoca 22 (42%) 11 (73%) Cough 15 (29%) 1 (7%) Increased work of breathing 23 (44%) 10 (67%) Vomiting 27 (52%) 10 (67%) Rhinitis 5 (10%) 0 Disease acuity PICU admission 37 (71%) 14 (93%) Median duration of PICU stay, days** 3 (2-3) 3.5 (2-5) Mechanical ventilation 24 (46%) 10 (67%) Inotropic support 26 (50%) 13 (87%) ECMO 1 (2%) 0 Multisystem inflammatory syndrome / PIMS-TS 24 (46%) 11 (73%) Markers of renal involvement Creatinine >1 but <1-5 x ULRI	Sex		
On immunosuppressive medication(s) 5 (10%) 0 COVID-19 Cilinical features at presentation Fever 46 (88%) 13 (87%) Abdominal pain 24 (46%) 7 (47%) Diarrhoca 22 (42%) 11 (73%) Cough 15 (29%) 1 (7%) Increased work of breathing 23 (44%) 10 (67%) Vomiting 27 (52%) 10 (67%) Rhinitis 5 (10%) 0 Disease acuity PICU admission 37 (71%) 14 (93%) Median duration of PICU stay, days** 3 (2-3) 3.5 (2-5) Mechanical ventilation 24 (46%) 10 (67%) Intortopic support 26 (50%) 13 (87%) ECMO 1 (2%) 0 Markers of renal involvement Creatinine >1 but <1.5 x ULR1 10 (19%) [range 37-114 μmol/L] * AKI 1 (creatinine >1.5-2 x ULRI) 7 (13%) [range 63-148 μmol/L] 7 (47%) AKI 2 (creatinine >2-3 x ULRI) 2 (4%) [range 111-133 μmol/L] 2 (13%) AKI 3 (creatinine >3 x ULRI) <th< td=""><td>Male</td><td>35 (67%)</td><td></td></th<>	Male	35 (67%)	
COVID-19 Clinical features at presentation Fever	Underlying comorbidities	29 (56%)	4 (27%)*
Clinical features at presentation	On immunosuppressive medication(s)	5 (10%)	0
Fever	COVID-19		•
Abdominal pain 24 (46%) 7 (47%)	Clinical features at presentation		
Diarrhoea 22 (42%) 11 (73%)	Fever	46 (88%)	13 (87%)
Cough	Abdominal pain	24 (46%)	7 (47%)
Increased work of breathing 23 (44%) 10 (67%) Vomiting 27 (52%) 10 (67%) Rhintis 5 (10%) 0 Disease acuity PICU admission 37 (71%) 14 (93%) Median duration of PICU stay, days** 3 (2-3) 3.5 (2-5) Mechanical ventilation 24 (46%) 10 (67%) Inotropic support 26 (50%) 13 (87%) ECMO 1 (2%) 0 Multisystem inflammatory syndrome / PIMS-TS 24 (46%) 11 (73%) Markers of renal involvement Creatinine >1 but <1·5 x ULRI 10 (19%) [range 37-114 μmol/L] ·· AKI 1 (creatinine >1·5·2 x ULRI) 7 (13%) [range 63-148 μmol/L] 7 (47%) AKI 2 (creatinine >2-3 x ULRI) 2 (4%) [range 111-133 μmol/L] 2 (13%) AKI 3 (creatinine >3 x ULRI) 6 (12%) [range 179-275 μmol/L] 6 (40%) Uraemia 26 (50%) [range 5·3-39·2 mmol/L] 15 (100%) [range 5·3-39·2 mmol/L] Proteinuria** 5 (10%) 2 (13%) Haematuria*** 5 (10%) 5 (33%) Renal ultrasonography performed 28 (54%) 11 (73%) Acute renal ultrasound abnormalities 11 (21%) 5 (33%)	Diarrhoea	22 (42%)	11 (73%)
Vomiting 27 (52%) 10 (67%) Rhinitis 5 (10%) 0 Disease acuity PICU admission 37 (71%) 14 (93%) Median duration of PICU stay, days** 3 (2-3) 3.5 (2-5) Mechanical ventilation 24 (46%) 10 (67%) Inotropic support 26 (50%) 13 (87%) ECMO	Cough	15 (29%)	1 (7%)
Rhinitis 5 (10%) 0	Increased work of breathing	23 (44%)	10 (67%)
Disease acuity PICU admission 37 (71%) 14 (93%) Median duration of PICU stay, days** 3 (2-3) 3.5 (2-5) Mechanical ventilation 24 (46%) 10 (67%) Inotropic support 26 (50%) 13 (87%) ECMO 1 (2%) 0 Multisystem inflammatory syndrome / PIMS-TS 24 (46%) 11 (73%) Markers of renal involvement Creatinine >1 but <1.5 x ULRI	Vomiting	27 (52%)	10 (67%)
PICU admission 37 (71%) 14 (93%) Median duration of PICU stay, days** 3 (2-3) 3.5 (2-5) Mechanical ventilation 24 (46%) 10 (67%) Inotropic support 26 (50%) 13 (87%) ECMO 1 (2%) 0 Multisystem inflammatory syndrome / PIMS-TS 24 (46%) 11 (73%) Markers of renal involvement Creatinine >1 but <1·5 x ULRI 10 (19%) [range 37-114 μmol/L] AKI 1 (creatinine >1·5-2 x ULRI) 7 (13%) [range 63-148 μmol/L] 7 (47%) AKI 2 (creatinine >2-3 x ULRI) 2 (4%) [range 111-133 μmol/L] 2 (13%) AKI 3 (creatinine >3 x ULRI) 6 (12%) [range 17-275 μmol/L] 6 (40%) Uraemia 26 (50%) [range 5·3-39·2 mmol/L] 15 (100%) [range 5·3-39·2 mmol/L] Proteinuria*** 5 (10%) 2 (13%) Haematuria**** 12 (23%) 5 (33%) Renal ultrasound abnormalities 11 (21%) 5 (33%)	Rhinitis	5 (10%)	0
Median duration of PICU stay, days** 3 (2-3) 3.5 (2-5) Mechanical ventilation 24 (46%) 10 (67%) Inotropic support 26 (50%) 13 (87%) ECMO 1 (2%) 0 Multisystem inflammatory syndrome / PIMS-TS 24 (46%) 11 (73%) Markers of renal involvement Creatinine >1 but <1.5 x ULRI	Disease acuity		•
Mechanical ventilation 24 (46%) 10 (67%) Inotropic support 26 (50%) 13 (87%) ECMO 1 (2%) 0 Multisystem inflammatory syndrome / PIMS-TS 24 (46%) 11 (73%) Markers of renal involvement Creatinine >1 but <1·5 x ULRI	PICU admission	37 (71%)	14 (93%)
Inotropic support 26 (50%) 13 (87%)	Median duration of PICU stay, days**	3 (2-3)	3.5 (2-5)
ECMO 1 (2%) 0 Multisystem inflammatory syndrome / PIMS-TS 24 (46%) 11 (73%) Markers of renal involvement Creatinine >1 but <1·5 x ULRI	Mechanical ventilation	24 (46%)	10 (67%)
Multisystem inflammatory syndrome / PIMS-TS 24 (46%) 11 (73%)	Inotropic support	26 (50%)	13 (87%)
Markers of renal involvement Creatinine >1 but <1·5 x ULRI	ECMO	1 (2%)	0
Creatinine >1 but <1·5 x ULRI 10 (19%) [range 37-114 μmol/L] AKI AKI 1 (creatinine >1·5·2 x ULRI) 7 (13%) [range 63-148 μmol/L] 7 (47%) AKI 2 (creatinine >2-3 x ULRI) 2 (4%) [range 111-133 μmol/L] 2 (13%) AKI 3 (creatinine >3 x ULRI) 6 (12%) [range 179-275 μmol/L] 6 (40%) Uraemia 26 (50%) [range 5·3-39·2 mmol/L] 15 (100%) [range 5·3-39·2 mmol/L] Proteinuria*** 5 (10%) 2 (13%) Haematuria**** 12 (23%) 5 (33%) Renal ultrasonography performed 28 (54%) 11 (73%) Acute renal ultrasound abnormalities 11 (21%) 5 (33%)	Multisystem inflammatory syndrome / PIMS-TS	24 (46%)	11 (73%)
AKI AKI 1 (creatinine >1·5·2 x ULRI)	Markers of renal involvement		
AKI AKI (creatinine >1·5-2 x ULRI) 7 (13%) [range 63-148 μmol/L] 7 (47%) AKI 2 (creatinine >2-3 x ULRI) 2 (4%) [range 111-133 μmol/L] 2 (13%) AKI 3 (creatinine >3 x ULRI) 6 (12%) [range 179-275 μmol/L] 6 (40%) Uraemia 26 (50%) [range 5·3-39·2 mmol/L] 15 (100%) [range 5·3-39·2 mmol/L] Proteinuria*** 5 (10%) 2 (13%) 2 (13%) Acute renal ultrasonography performed 28 (54%) 11 (73%) Acute renal ultrasound abnormalities 11 (21%) 5 (33%)	Creatinine >1 but <1.5 x ULRI	10 (19%) [range 37-114 μmol/L]	
AKI 2 (creatinine >2-3 x ULRI) AKI 3 (creatinine >3 x ULRI) Uraemia Proteinuria*** 5 (10%) 12 (23%) 2 (13%) 2 (40%) [range 111-133 μmol/L] 2 (13%) 6 (40%) 15 (100%) [range 5·3-39·2 mmol/L] 2 (13%) 2 (13%) 4 (213%) 5 (33%) Renal ultrasonography performed 28 (54%) Acute renal ultrasound abnormalities 11 (21%) 5 (33%)	AKI		•
AKI 2 (creatinine >2-3 x ULRI) AKI 3 (creatinine >3 x ULRI) Uraemia Proteinuria*** 5 (10%) 12 (23%) 2 (13%) 2 (40%) [range 111-133 μmol/L] 2 (13%) 6 (40%) 15 (100%) [range 5·3-39·2 mmol/L] 2 (13%) 2 (13%) 4 (213%) 5 (33%) Renal ultrasonography performed 28 (54%) Acute renal ultrasound abnormalities 11 (21%) 5 (33%)	AKI 1 (creatinine >1.5-2 x ULRI)	7 (13%) [range 63-148 umol/L]	7 (47%)
AKI 3 (creatinine >3 x ULRI) 6 (12% [range 179-275 μmol/L] 6 (40%) Uraemia 26 (50%) [range 5·3-39·2 mmol/L] 15 (100%) [range 5·3-39·2 mmol/L] Proteinuria*** 5 (10%) 2 (13%) Haematuria**** 12 (23%) 5 (33%) Renal ultrasonography performed 28 (54%) Acute renal ultrasound abnormalities 11 (21%) 5 (33%)	AKI 2 (creatinine >2-3 x ULRI)	` / [U	2 (13%)
Uraemia 26 (50%) [range 5·3-39·2 mmol/L] 15 (100%) [range 5·3-39·2 mmol/L] Proteinuria*** 5 (10%) 2 (13%) Haematuria**** 12 (23%) 5 (33%) Renal ultrasonography performed 28 (54%) 11 (73%) Acute renal ultrasound abnormalities 11 (21%) 5 (33%)	AKI 3 (creatinine >3 x ULRI)		6 (40%)
Proteinuria*** 5 (10%) 2 (13%) Haematuria**** 12 (23%) 5 (33%) Renal ultrasonography performed 28 (54%) 11 (73%) Acute renal ultrasound abnormalities 11 (21%) 5 (33%)			15 (100%) [range 5:3-39:2 mmol/L]
Haematuria**** 12 (23%) 5 (33%) Renal ultrasonography performed 28 (54%) 11 (73%) Acute renal ultrasound abnormalities 11 (21%) 5 (33%)		71 8	1 /1 5
Renal ultrasonography performed28 (54%)11 (73%)Acute renal ultrasound abnormalities11 (21%)5 (33%)	Haematuria****		
Acute renal ultrasound abnormalities 11 (21%) 5 (33%)	Renal ultrasonography performed		
	Acute renal ultrasound abnormalities		
Requirement for CRR1	Requirement for CRRT	0	0

Data are n (%) or median (IQR). AKI = acute kidney injury. CRRT = continuous renal replacement therapy. ECMO = extracorporeal membrane oxygenation. PICU = paediatric intensive care unit. PIMS-TS = paediatric inflammatory multisystem syndrome temporarily associated with SARS-CoV-2. ULRI = upper limit of reference interval.

^{*}Underlying comorbidities were methylmalonic acidaemia (MMA), obesity, prematurity, and type 1 diabetes mellitus. **Maximum duration of PICU stay was 12 days. ***22/52 (42%) were screened for proteinuria. Proteinuria was detected in 5/22 (23%) screened for it. Proteinuria was detected in 2/8 (25%) of all AKI patients screened for it. ****40/52 (77%) were screened for haematuria. Haematuria was detected in 12/40 (30%) screened for it. Haematuria was detected in 5/14 (36%) of all AKI patients screened for it.

Figure – Median serum creatinine and median estimated GFR values with interquartile range for the AKI cohort (n=15) followed during 12 days of admission (where data was available during that time period)



Days of admission

Estimated GFR values were calculated using revised Schwartz equation, where k = 36.5. Where height data was not available, height was substituted by the 50^{th} percentile value for age. Twelve days of admission was chosen as this was the longest duration of stay in PICU by any one patient. eGFR = estimated glomerular filtration rate. Q1 = first quartile. Q3 = third quartile.