

Cohort study of outpatient haemodialysis management strategies for COVID-19 in North-West London

Supplementary material

Author list and affiliations

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Running title:

Management of haemodialysis outpatients with COVID-19

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Characteristic	Diarrhoea	No diarrhoea	P value
Number, n	21 (20)	85 (80)	
Age, mean years	57 (50-69)	65 (56-75)	0.1
Female	7 (33)	33 (38)	0.8
BAME	15 (71)	74 (87)	0.1
Diabetes	11 (52)	46 (54)	> 0.99
Transplant list active	6 (29)	18 (21)	0.6
Days from swab, median	3	2	0.4
Patients on antibiotics	2	3	0.23
Symptoms			
Fever	20 (95)	67 (79)	0.1
Cough	15 (71)	32 (38)	0.007
Breathlessness	4 (19)	26 (31)	0.42
Nausea	4 (19)	5 (6)	0.07
Myalgia	10 (48)	18 (21)	0.03
SBP pre HD, mmHg	136 (118-164)	152 (135-166)	0.2
SaO ₂ pre HD, percentage	98 (97-100)	99 (96-100)	0.7
Mean weight change post HD,kg	-1.9 (-2.2 to -1.2)	-1.5 (-2.0 to -1.0)	0.3

Supplementary table S1: Characteristics of patients with diarrhoea at first haemodialysis session following COVID-19 diagnosis. Data are reported as n (%) for categorical variables and median (interquartile range) for continuous variables. Differences are calculated with Fisher's exact test for categorical and Mann-Whitney test for continuous variables. BAME, Black, Asian and Minority Ethnic groups. SaO₂, oxygen saturations measured by peripheral pulse oximetry. SBP, systolic blood pressure. DBP, diastolic blood pressure. HD, haemodialysis.

Characteristic	All patients	Outpatient	Admitted	P value	Survived	Died	P value
Number of patients, n	85	56 (66)	29 (34)		69 (81)	16 (19)	
Age	65 (54-77)	62 (52-72)	75 (61-80)	0.04 ^a	65 (53-73)	76 (61-80)	0.02 ^b
Female	33 (39)	20 (36)	13 (44)	0.5	24 (35)	9 (56)	0.2
BAME	72 (85)	45 (80)	27 (93)	0.2	56 (81)	16 (100)	0.1
Active on transplant list	24 (27)	19 (34)	4 (14)	0.07	21 (30)	2 (13)	0.2
Uses hospital-provided transport	30 (35)	14 (25)	16 (55)	0.008 ^c	25 (36)	5 (31)	0.8
Diabetes	45 (53)	30 (54)	15 (52)	>0.99	36 (52)	9 (56)	0.8
Prescribed ACEi or ARB	28 (33)	22 (39)	6 (21)	0.09	26 (38)	2 (13)	0.08
Prescribed immunosuppression	11 (13)	7 (13)	4 (14)	>0.99	10 (14)	1 (6)	0.7
Cause ESKD							
Genetic	8 (9)	8 (14)	0 (0)	0.05 ^d	8 (12)	0 (0)	0.3
Autoimmune	14 (16)	13 (23)	1 (3)	0.03 ^e	14 (20)	0 (0)	0.06
Diabetes	35 (41)	18 (32)	17 (59)	0.02 ^f	24 (35)	11 (69)	0.02 ^g
Other vascular disease	16 (19)	10 (18)	7 (24)	0.6	13 (19)	4 (25)	0.7
Other	11 (13)	7 (13)	4 (14)	>0.99	10 (14)	1 (6)	0.7
Symptoms							
Fever (> 37.8 °C)	70 (82)	45 (80)	25 (86)	0.6	55 (80)	15 (94)	0.3
Cough	41 (48)	27 (48)	14 (48)	>0.99	34(49)	7 (44)	0.8
Breathlessness	20 (24)	10 (18)	10 (34)	0.1	16 (23)	4 (25)	>0.99
Myalgia	23 (27)	17 (30)	6 (21)	0.4	19 (28)	4 (25)	>0.99
Diarrhoea	14 (16)	14 (25)	0 (0)	0.002 ^h	14 (21)	0 (0)	0.06
Coryza	14 (16)	8 (14)	6 (21)	0.5	13 (19)	1 (6)	0.3
Nausea	8 (13)	7 (18)	1 (5)	0.2	7 (14)	1 (8)	>0.99
Clinical observations pre HD							
SaO ₂ (%)	98 (97-100)	99 (97-100)	98 (94-99)	0.01 ⁱ	99 (97-100)	98 (93-99)	0.05 ^j
SBP (mmHg)	149 (133-164)	147 (130-164)	152 (136-169)	0.6	149 (131-163)	153 (138-175)	0.5
DBP (mmHg)	73 (64-88)	77 (65-88)	70 (59-86)	0.1	77 (64-88)	69 (61-85)	0.2
Blood tests							
HB, g/L (NR 114-150)	109 (98-120)	112 (96-122)	108 (99-113)	0.3	109 (97-120)	108 (100-116)	0.9
WCC, x10 ⁹ /L (NR 4.2-11.2)	4.6 (3.9-6.2)	4.3 (3.8-6.0)	4.9 (3.9-7.6)	0.3	4.3 (3.8-5.9)	5.7 (4.9-9.7)	0.002 ^k
Lymphocytes, x10 ⁹ /L (NR 1.1-3.6)	0.9 (0.7-1.5)	1.0 (0.7-1.5)	0.8 (0.6-1.5)	0.4	0.9 (0.7-1.5)	0.9 (0.6-1.4)	0.5
PLT, x10 ⁹ /L (NR 135-400)	160 (128-228)	166 (135-230)	149 (111-207)	0.2	159 (130-228)	171 (110-227)	0.9
CRP, mg/L (NR <5)	37 (13-101)	29 (10-71)	82 (17-184)	0.003 ^l	29 (11-76)	142 (37-205)	0.0001 ^m
ALT, unit/L (NR <34)	14 (9-19)	14 (9-19)	13 (10-16)	0.7	14 (9-19)	14 (8-16)	0.7
LDH, unit/L (NR 125-243)	278 (226-364)	251 (221-341)	301 (250-407)	0.04 ⁿ	251 (221-338)	341 (290-467)	0.003 ^o
Ferritin, µg/L (NR 20-300)	765 (491-1312)	723 (434-1041)	820 (596-2097)	0.03 ^q	758 (478-1272)	864 (588-1893)	0.3
CK, unit/L (NR 25-200)	88 (63-185)	88 (63-167)	89 (60-229)	0.5	84 (64-159)	132 (52-334)	0.4
Troponin, ng/L (NR <15)	35 (22-111)	29 (19-70)	62 (31-206)	0.004 ^r	31 (20-88)	63 (39-207)	0.005 ^s
D-dimer, µg/L (NR <500)	1353 (833-2694)	1171 (674-2044)	1799 (1209-3520)	0.008 ^t	1273 (761-2228)	2166 (1209-3533)	0.01 ^u

Supplementary table S2: Characteristics at first haemodialysis session following COVID-19 diagnosis of patients without initial hospital admission (IsoHD-first cohort)

The Outpatient cohort did not require admission to hospital during the course of COVID19 disease and recovery. The Admitted cohort received inpatient care and haemodialysis at any point during COVID19 disease. Data are reported as n (%) for categorical variables and median (interquartile range) for continuous variables. Differences were calculated with Fisher's exact test for categorical and Mann-Whitney test for continuous variables.

BAME, Black, Asian and Minority Ethnic groups. ACEi, angiotensin-converting enzyme inhibitor. ARB, angiotensin 2 receptor blocker. ESKD, end-stage kidney disease. SaO₂, oxygen saturations measured by peripheral pulse oximetry. SBP, systolic blood pressure. DBP, diastolic blood pressure. HD, haemodialysis. NR, normal range. HB, haemoglobin. WCC, white cell count. Lymphocytes, lymphocyte count. PLT, platelet count. CRP, c-reactive protein. ALT, alanine aminotransferase. LDH, lactate dehydrogenase. CK, creatinine kinase.

^a Difference between medians 13 years (95% confidence interval (CI) 3-16 years)

^b Difference between medians 11 years (95% CI 2-17 years)

^c Odds ratio (OR) for admission for using hospital-provided transport = 3.7 (95% CI 1.48-9.47)

^d OR for admission for patients with genetic causes of ESKD = 0.0 (95% CI 0.00-0.85)

^e OR for admission for patients with autoimmune causes of ESKD = 0.1 (95% CI 0.01-0.73)

^f OR for admission for patients with diabetes as cause of ESKD = 3.0 (95% CI 1.13-7.75)

^g OR for death for patients with diabetes as cause of ESKD = 4.1 (95% CI 1.33-11.7)

^h OR for admission for diarrhoea at first dialysis post SARS-CoV2 diagnosis = 0 (95% CI 0.00-0.36)

ⁱ Difference between medians 1% SaO₂ (95% CI 0.01-2)

^j Difference between medians 1% SaO₂ (95% CI 0.01-3)

^k Difference between medians 1.4 x10⁹/L (95% CI 0.6-3.1)

^l Difference between medians 53 mg/L (95% CI 8-87)

^m Difference between medians 113 mg/L (95% CI 28-137)

ⁿ Difference between medians 50 unit/L (95% CI 1-88)

^o Difference between medians 90 unit/L (95% CI 29-135)

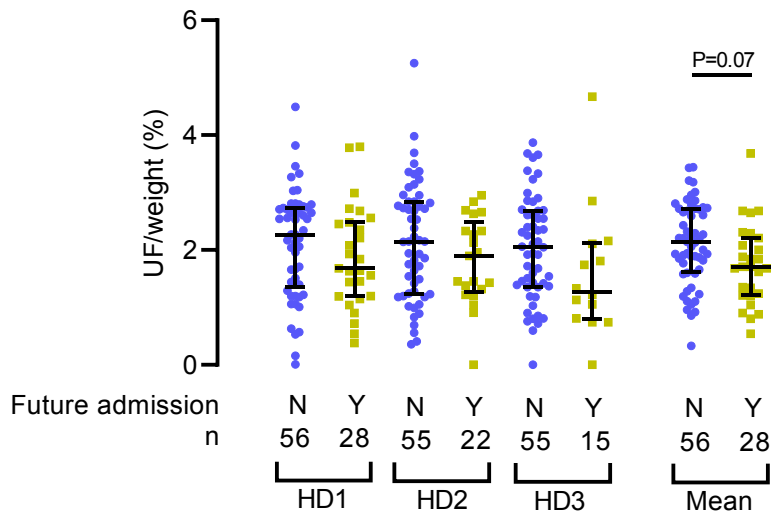
^q Difference between medians 97 µg/L (95% CI 29-592)

^r Difference between medians 33 ng/L (95% CI 9-84)

^s Difference between medians 32 ng/L (95% CI 9-94)

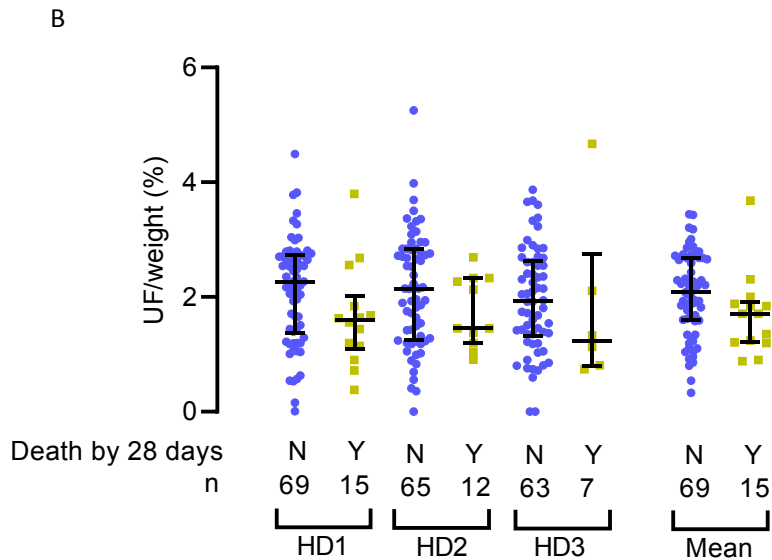
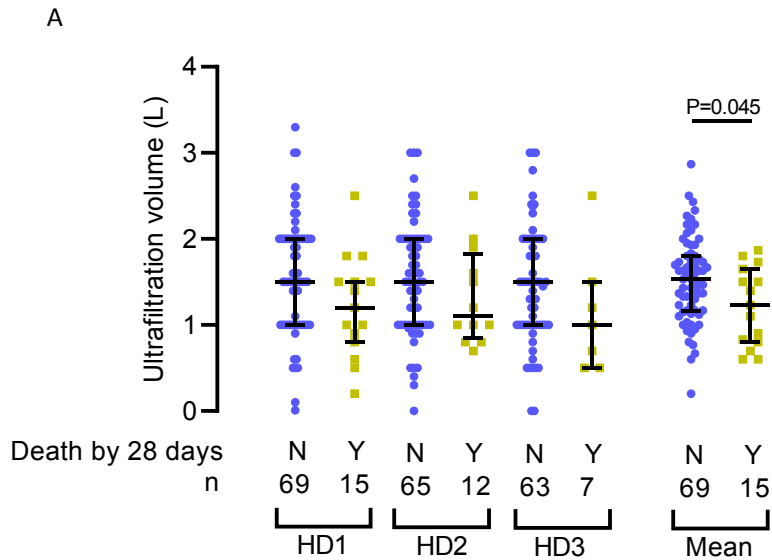
^t Difference between medians 628 µg/L (95% CI 173-1260)

^u Difference between medians 893 µg/L (95% CI 103-1773)



Supplementary Figure S1: Net dialysis ultrafiltration as percentage of pre dialysis weight (UF/weight) at the first three consecutive isolated haemodialysis sessions (HD1, HD2, HD3) in cohorts of patients with COVID-19 who required future hospital admission

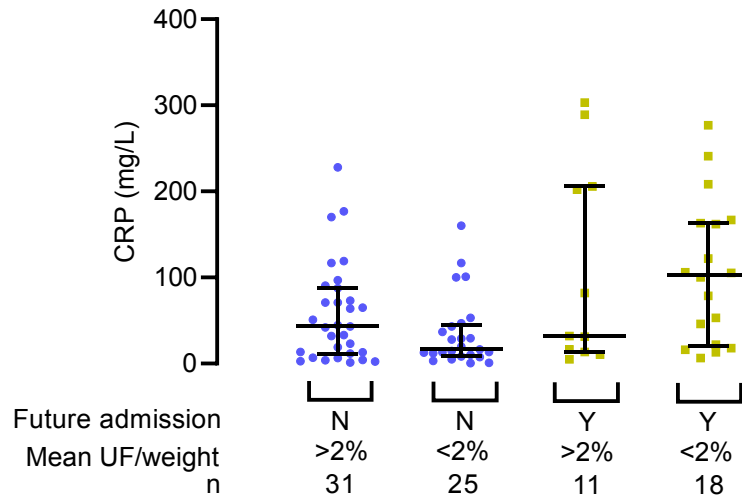
Data are divided by the presence (Y, yes, yellow squares) or absence (N, no, blue circles) of future hospital admission. n, number. UF was not available from HD1 for one patient who required future admission.



Supplementary Figure S2: Haemodialysis ultrafiltration (UF) at the first three consecutive haemodialysis sessions following COVID-19 diagnosis (HD1, HD2, HD3) and survival at 28 days.

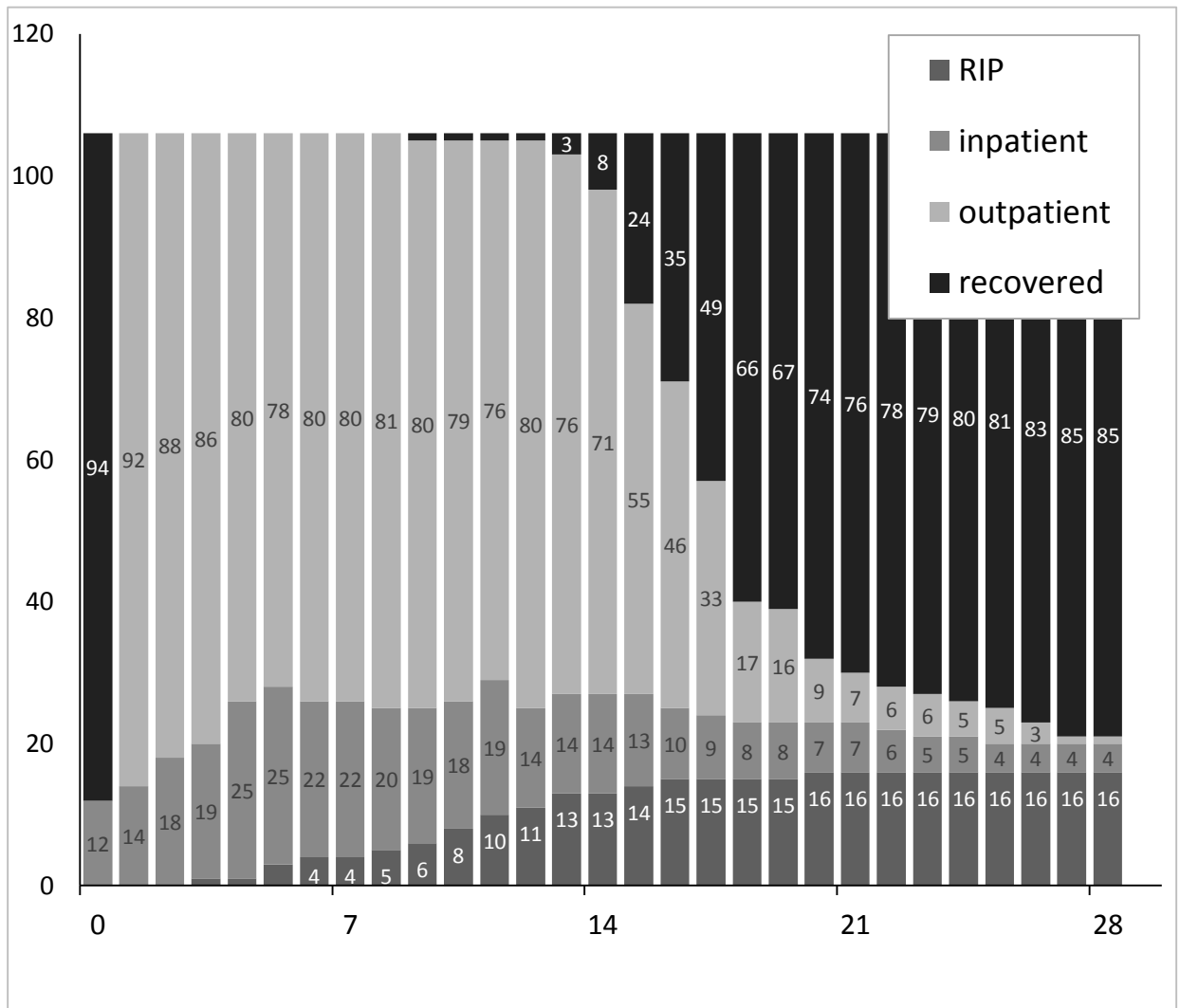
Net UF (A) and net UF as percentage of pre dialysis weight (UF/weight) (B) at the first three consecutive isolated haemodialysis and mean HD1-HD3 in cohorts of patients who died at 28 days post COVID-19 diagnosis. UF was not available from HD1 for one patient who died.

Y, yes, yellow squares. N, no, blue circles. n, number.



Supplementary Figure S3: C-reactive protein (CRP) at first dialysis post COVID-19, ultrafiltration volumes of more than 2% pre-dialysis weight and future hospital admission.

Y, yes, yellow squares. N, no, blue circles. n, number.



Supplementary Figure S4: Clinical status of patients managed at the isolated outpatient haemodialysis unit dedicated to patients with COVID-19 at each day from COVID-19 diagnosis

Each column represents one day from COVID-19 diagnosis. Clinical status was categorised as recovered from symptoms (recovered), ongoing symptoms and isolated outpatient haemodialysis (outpatient), receiving inpatient care (inpatient) and died (RIP). Columns are labelled with numbers of patients in each clinical status category on each day. At 28 days from diagnosis, the majority of patients had recovered without needing inpatient admission.

Supplementary Appendix: Senior clinicians at the Imperial College Healthcare NHS Trust Renal and Transplant Centre caring for these patients and collaborating with this investigation

M Appelbe	G Lucisano
DR Ashby	K Lynch
E Brown	S McAdoo
T Cairns	A Mclean
R Charif	N Medjeral-Thomas
M Condon	D Moabi
RW Corbett	A Muthusamy
N Duncan	M Nevin
C Edwards	A Palmer
A Frankel	D Parsons
M Griffith	V Prout
J Harris	S Punzalan
S Harris	E Salisbury
P Hill	E Sandhu
C Jones	C Smith
A Kousios	A Tanna
JB Levy	D Thomas
L Lightstone	J Tomlinson
L Liu	P Webster
M Loucaidou	M Willicombe