ERACODA

- The ERA-EDTA COVID-19 Database for Patients on Kidney Replacement Therapy -

April 7, 2020

First ERACODA Study Report

Dear Colleagues and Friends,

As you may know ERACODA went live last week. ERACODA is an acronym for the ERA-EDTA database that collects individual level data of kidney patients with COVID-19. This database has been established to achieve detailed insight in patient and treatment characteristics that are related to outcome. We hope that such knowledge can help improve the prognosis of the patients we care for by intervening on modifiable risk factors.

Although we started only 4 working days ago, this pan-European initiative concerns already the largest publicly available series of patients on kidney replacement therapy with COVID-19, after initial preliminary reports from China (n=37 hemodialysis patients), Italy (n=18 hemodialysis patients) and the United States of America (n=44 kidney transplant patients).

We are proud to present you here a first detailed report. Some key data:
- 146 individuals have registered as user, representing 109 centres and 24 European countries.
- 100 patient records have already been entered. An analysis of the first 80 records shows that approximately 75% relate to kidney transplant and 25% to dialysis patients. Average age is 56.1 years, 57% being male, with a BMI of 25.8.
- 27% of these patients were sent home after an initial diagnosis of COVID-19, whereas 73% was admitted to hospital, of which 21% to an ICU. Seven deaths have currently been reported, but it is impossible to draw any conclusions on mortality rates, because follow-up time is still limited.

Although we have done our best to provide good science, we want to emphasize that the data that we present are preliminary. There is for several variables a considerable percentage of missing data. To be transparent we have indicated this in our tables. Some data also need validation. In the coming days we will send out queries to resolve this. Given these considerations we caution, however, that on the present data set no firm conclusions should be drawn.

We urgently ask the members of the ERA-EDTA to help fill our COVID-19 database as rapidly as possible. More data, especially representative data, are needed.

Please send us therefore not only the cases with bad outcomes, but unbiased information on all (!) your patients with COVID-19, independent of their clinical course.

You will be acknowledged for your contribution on any manuscripts to derive from this initiative. Please spread the news about this database among your colleagues.

How to register as a user:
Please send an e-mail to COVID.19.KRT@umcg.nl. This e-mail should contain:
- First name and surname
- Institution (in English) + country
We will reply as soon as possible with further details and instructions.

In case you have any questions or comments, please let us know via the above e-mail address.

Best regards,

Dr. Lyanne Kieneker, Chief Project Coordinator and Epidemiologist
Dr. Michelle Pena, Epidemiologist
Ms. Hanne de Vries, Project Coordinator

On behalf of the ERACODA Working Group

Casper Franssen, Lead Dialysis Sub-database
Luuk Hilbrands, Lead Kidney Transplant Sub-database
Ron Gansevoort, Member ERA-EDTA Council
Marc Hemmelder, Director Dutch National KRT Registry
Kitty Jager, Director ERA-EDTA Registry

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Overall data set (weekly output)

Country specific data sets (biweekly output, starting April 15, 2020)

Same tables as above, but country specific (only for countries with >40 patients entered)

Patient and COVID-19 characteristics at presentation

According to type of kidney replacement therapy

Table 1

	Kidney transplant patients	Dialysis patients	Missing data (n)
Number of patients, N	60	20	
Male sex, %	65	35	
Age, y	58 ± 15	51 ± 21	
BMI, kg/m^2	25 ± 4	27 ± 9	31/4
Race			35/0
Asian, %	0	0	
Black or African descent, %	0	5	
White or Caucasian, %	100	90	
Other, %	0	5	
Tobacco use			31/1
Current, %	3	0	
Prior, %	24	11	
Never, %	52	42	
Unknown, %	21	47	
Primary kidney disease			
Primary glomerulonephritis, %	NA	5	
Pyelonephritis, %	NA	5	
Interstitial nephritis, %	NA	5	
Familial/hereditary renal diseases, %	NA	5	
Congenital diseases, %	NA	0	
Vascular diseases, %	NA	15	
Secondary glomerular/systemic disease, %	NA	5	
Diabetic kidney disease, %	NA	45	
Other, %	NA	15	
Unknown, %	NA	0	
Hemodialysis, %	NA	90	
Peritoneal dialysis, %	NA	10	
Residual diuresis > +/- 200 ml/day	NA	65	
Comorbidities			
Obesity, %	5	25	31/1
Hypertension, %	65	75	
Diabetes Mellitus, %	30	55	
Cornonary artery disease, %	30	25	
Heart failure, %	5	15	

Chronic lung disease, %	10	5	
Active malignancy, %	2	5	
Auto-immune disease, %	2	5	
Use of RAASi use at presentation			
ACE-inhibitors, %	28	6	2/2
ARB, %	16	11	2/2
Use of immunosuppressive medication at presentation			
Prednisone, %	87	15	7/17
Tacrolimus, %	81	5	8/17
Cyclosporine, %	20	0	25/17
Mycophenolate, %	75	0	12/17
mTOR inhibitor, %	14	5	23/17
Azathioprine, %	11	5	24/17
Belatacept, %	0	0	26/17
Anti TNF A, %	0	0	25/17
Rituximab, %	0	0	25/17
Cyclophosphamide, %	0	0	25/17
Other, %	0	0	25/17
COVID-19 symptoms			
Sore throat, %	9	10	27/0
Cough, %	84	55	9/0
Shortness of breath, %	50	15	18/0
Fever, %	60	37	25/1
Headache, %	21	15	26/0
Nausea or vomiting, %	29	20	18/0
Diarrhea, %	43	10	18/0
Myalgia or arthalgia, %	35	10	23/0
Temperature, Celcius	38 ± 1	38 ± 1	6/3
Respiration rate, /minute	20 ± 7	19 ± 8	12/5
Oxygen saturation with room air, %	95 ± 3	97 ± 2	11/4
Systolic blood pressure, mm Hg	132 ± 24	143 ± 21	10/2
Diastolic blood pressure, mm Hg	79 ± 17	73 ± 18	10/2
Pulse rate, BPM	86 ± 15	86 ± 19	11/7
COVID-19 test result positive, %	98	95	6/0
Abnormalities chest X-ray suggestive for COVID-19, %	33	21	5/1
Abnormalities CT-scan suggestive for COVID-19, %	33	26	6/1

Laboratory results			
Lymphocyte count, x1000/microL	0.6 (0.5-1.1)	0.8 (0.6-1.7)	37/8
eGFR, mL/min	48 (30-65)	NA	31/3
CRP, mg/L	64 (24-100)	18 (8-84)	31/4

Continuous variables are reported as mean ± SD or median (IQR). eGFR is calculated with the creatinine-based CKD-EPI formula. Obesity is defined as BMI > 30 kg/m^2. Abbreviations: ACE, angiotensin converting enzyme; ARB, angiotensin receptor blocker; BMI, body mass index; COVID-19, corona virus disease 2019; CRP, C-reactive protein; eGFR, estimated glomerular filtration rate; mTOR, mammalian target of rapamycin; NA, not applicable; TNF, tumor necrosis factor.

Patient and COVID-19 characteristics at presentation

For patients with a kidney transplant, according to hospital status

Table 2

	Control group	Patients with a kidney transplant			
			Admitted to		
		Not admitted	Hospital, no ICU	ICU	Deceased *
Number of patients, N		14	32	9	5
Number of patients, %		25	58	16	9
Male sex, %		71	69	22	40
Age, y		58 ± 8	57 ± 18	56 ± 17	74 ± 10
BMI, kg/m^2		25 ± 3	25 ± 5	25 ± 4	28 ± 9
Race					
Asian, %		0	0	0	0
Black or African descent, %		0	0	0	0
White or Caucasian, %		100	100	100	100
Other, %		0	0	0	0
Tobacco use					
Current, %		0	0	25	33
Prior, %		43	14	25	0
Never, %		57	50	50	67
Unknown, %		0	36	0	0
Comorbidities					
Obesity, %		0	6	0	20
Hypertension, %		71	59	67	60
Diabetes Mellitus, %		29	38	22	60
Cornonary artery disease, %		36	31	22	40
Heart failure, %		0	6	11	20
Chronic lung disease, %		7	13	11	40
Active malignancy, %		0	3	0	20
Auto-immune disease, %		0	3	0	0
Use of RAASi use at presentation					
ACE-inhibitors, %		38	22	25	0
ARB, %		0	19	25	40
Use of immunosuppressives at presentation					
Prednisone, %		100	89	86	100
Tacrolimus, %		100	77	63	80
Cyclosporine, %		100	24	29	25

Mycophenolate, %		80	76	63	50
mTOR inhibitor (sirolimus, everolimus), %		29	11	0	20
Azathioprine, %		0	22	0	0
Belatacept, %		0	0	0	0
Anti TNF A, %		0	0	0	0
Rituximab, %		0	0	0	0
Cyclophosphamide, %		0	0	0	0
Other, %		0	0	0	0
COVID-19 symptoms					
Sore throat, %	NA	13	13	20	0
Cough, %	NA	83	81	100	100
Shortness of breath, %	NA	11	57	63	75
Fever, %	NA	88	44	40	67
Headache, %	NA	25	29	0	0
Nausea or vomiting, %	NA	30	36	17	50
Diarrhea, %	NA	40	50	50	50
Myalgia or arthalgia, %	NA	38	35	40	33
Temperature, Celcius	NA	38 ± 1	38 ± 1	37 ± 1	38 ± 1
Respiration rate, /minute	NA	17 ± 4	20 ± 6	20 ± 9	20 ± 7
Oxygen saturation with room air, %	NA	96 ± 2	95 ± 4	95 ± 3	93 ± 5
Systolic blood pressure, mm Hg	NA	129 ± 17	139 ± 28	120 ± 17	142 ± 22
Diastolic blood pressure, mm Hg	NA	76 ± 9	83 ± 18	73 ± 19	76 ± 13
Pulse rate, BPM	NA	81 ± 19	90 ± 14	82 ± 13	83 ± 3
COVID-19 test result positive, %	NA	100	96	100	100
Suggestive abnormalities X-ray, %	NA	23	30	50	40
Suggestive abnormalities CT-scan, %	NA	8	37	63	60
Laboratory results					
Lymphocyte count, x1000/microL	NA	1.3 (0.4-2.1)	0.8 (0.5-1.1)	0.6 (0.6-0.6)	0.6 (0.2-1.1)
eGFR, mL/min	NA	48 (13-75)	47 (32-65)	28 (15-65)	34 (25-46)
CRP, mg/L	NA	34 (17-63)	62 (24-106)	186 (121-287)	159 (139-171)

Continuous variables are reported as mean ± SD or median (IQR). eGFR is calculated with the creatinine-based CKD-EPI formula. Obesity is defined as BMI > 30 kg/m^2. Abbreviations: ACE, angiotensin converting enzyme; ARB, angiotensin receptor blocker; BMI, body mass index; COVID-19, corona virus disease 2019; CRP, C-reactive protein; eGFR, estimated glomerular filtration rate; mTOR, mammalian target of rapamycin; NA, not applicable; TNF, tumor necrosis factor.

Patient and COVID-19 characteristics at presentation

For patients on dialysis, according to hospital status

Table 3

	Control group	Patients on dialysis			
			Admitted to		
		Not admitted	Hospital, no ICU	ICU	Deceased
Number of patients, N		7	9	1	1
Number of patients, %		41	53	6	6
Male sex, %		0	56	0	100
Age, y		42 ± 26	53 ± 19	55	38
BMI, kg/m^2		26 ± 13	26 ± 6	-	25
Race					
Asian, %		0	0	0	0
Black or African descent, %		14	0	0	0
White or Caucasian, %		86	100	100	100
Other, %		0	0	0	0
Unknown, %		0	0	0	0
Tobacco use					
Current, %		0	0	0	0
Prior, %		14	11	0	0
Never, %		43	22	100	100
Unknown, %		43	67	0	0
Primary kidney disease					
Primary glomerulonephritis, %		0	11	0	100
Pyelonephritis, %		0	11	0	0
Interstitial nephritis, %		14	0	0	0
Familial/hereditary renal diseases, %		0	0	100	0
Congenital diseases, %		0	0	0	0
Vascular diseases, %		14	22	0	0
Secondary systemic disease, %		0	11	0	0
Diabetic kidney disease, %		29	44	0	0
Other, %		43	0	0	0
Unknown, %		0	0	0	0
Hemodialysis, %		100	89	0	100
Peritoneal dialysis, %		0	11	100	0
Residual diuresis > +/- 200 ml/day		57	67	100	100
Comorbidities					

Obesity, %		29	22	0	0
Hypertension, %		71	89	100	100
Diabetes Mellitus, %		43	56	100	0
Cornonary artery disease, %		14	44	0	0
Heart failure, %		14	22	0	0
Chronic lung disease, %		0	11	0	0
Active malignancy, %		0	11	0	0
Auto-immune disease, %		0	11	0	0
Use of RAASi use at presentation					
ACE-inhibitors, %		0	11	-	0
ARB, %		14	0	-	0
Use of immunosuppressives at presentation					
Prednisone, %		29	11	-	-
Tacrolimus, %		14	0	-	-
Cyclosporine, %		0	0	-	-
Mycophenolate, %		0	0	-	-
mTOR inhibitor (sirolimus, everolimus), %		14	0	-	-
Azathioprine, %		0	11	-	-
Belatacept, %		0	0	-	-
Anti TNF A, %		0	0	-	-
Rituximab, %		0	0	-	-
Cyclophosphamide, %		0	0	-	-
Other, %		0	0	-	-
COVID-19 symptoms					
Sore throat, %	NA	0	11	100	0
Cough, %	NA	57	56	100	100
Shortness of breath, %	NA	0	33	0	0
Fever, %	NA	14	56	100	100
Headache, %	NA	0	11	100	0
Nausea or vomiting, %	NA	14	11	0	0
Diarrhea, %	NA	14	0	0	0
Myalgia or arthalgia, %	NA	0	11	0	0
Temperature, Celcius	NA	37 ± 1	38 ± 2	-	40
Respiration rate, /minute	NA	17 ± 3	22 ± 10	-	16
Oxygen saturation with room air, %	NA	98 ± 2	96 ± 3	-	98
Systolic blood pressure, mm Hg	NA	139 ± 21	140 ± 16	-	120
Diastolic blood pressure, mm Hg	NA	72 ± 17	76 ± 21	-	70
Pulse rate, BPM	NA	82 ± 3	90 ± 23	-	78
COVID-19 test result positive, %	NA	100	89	100	100

Suggestive abnormalities X-ray, %	NA	0	33	100	100
Suggestive abnormalities CT-scan, %	NA	0	56	0	100
Laboratory results					
Lymphocyte count, x1000/microL	NA	2.4 (0.7-2.9)	0.7 (0.5-1.0)	-	1.1
eGFR, mL/min	NA	NA	NA	NA	NA
CRP, mg/L	NA	8 (4-15)	46 (23-124)	-	35

Continuous variables are reported as mean ± SD or median (IQR). eGFR is calculated with the creatinine-based CKD-EPI formula. Obesity is defined as BMI > 30 kg/m^2. Abbreviations: ACE, angiotensin converting enzyme; ARB, angiotensin receptor blocker; BMI, body mass index; COVID-19, corona virus disease 2019; CRP, C-reactive protein; eGFR, estimated glomerular filtration rate; mTOR, mammalian target of rapamycin; NA, not applicable; TNF, tumor necrosis factor.

Follow-up data of KRT patients with COVID-19

According to type of kidney replacement therapy

Table 4.

	Kidney transplant Patients (n=60)	Dialysis Patients (n=20)	Missing data (n)
Hospitalisation, %	80	61	1/2
Reason for no hospital admission			55/13
No indication, %	100	100	
Logistical reasons related to COVID-19, %	0	0	
Patient/family preferred no admission, %	0	0	
ICU admission, %	23	10	4/1
Reason for no ICU admission			32/2
No indication, %	80	89	
Logistical reasons related to COVID-19, %	0	11	
Patient/family preferred no admission, %	0	0	
Prognosis was too bad, %	20	0	
Intubation, %	22	10	6/1
Reason for no intubation			31/2
No indication, %	75	78	
Logistical reasons related to COVID-19, %	6	22	
Patient/family preferred no admission, %	0	0	
Prognosis was too bad, %	19	0	
Start of CVVH/hemodialysis, %	14	-	25/11
Reasons not to start CVVH/hemodialysis			29/11
No indication, %	100	NA	
Logistical reasons related to COVID-19, %	0	-	
Patient/family preferred no admission, %	0	-	
Prognosis was too bad, %	0	-	
Continuing kidney replacement therapy during admission, %	NA	100	-/1
Increase in intensity kidney replacement therapy, %	NA	0	-/1
Reason for discontinuation of kidney replacement therapy			
No indication, %	NA	-	
Logistical reasons related to COVID-19, %	NA	-	
Patient/family preferred no admission, %	NA	-	
Prognosis was too bad, %	NA	-	

Continuous variables are reported as mean ± SD or median (IQR). Abbreviations: CVVH, continuous veno-venous hemofiltration; COVID-19, corona virus disease 2019; ICU, intensive care unit; NA, not applicable.

Follow-up data for patients with a kidney transplant with COVID-19

According to hospital status

Table 5.

	Not admitted to hospital (n=12)	Admitted to hospital, no ICU (n=33)	Admitted to ICU (n=10)	Deceased (n=6)
Antiviral therapy, %	0	69	89	60
(Hydroxy)chloroquine , %	0	100	100	100
Lopinavir/ritonavir, %	0	0	40	0
Remdesevir, %	0	0	20	0
Interferon, %	0	0	20	0
Other, %	0	10	20	0
Anti-inflammatory therapy, %	0	0	0	0
Tocilizumab, %	0	0	0	0
Anakinra, %	0	0	0	0
High dose steroids, %	0	0	0	0
Other, %	0	0	0	0
ACE-inhibitor use				
Continued, %	100	50	0	0
Discontinued, %	0	50	100	100
Replaced by ARB, %	0	0	0	0
ARB use				
Continued, %	NA	50	50	50
Discontinued, %	NA	50	50	50
Change in dose immunosuppressive drugs < 48h after presentation				
Tacrolimus				
No change, %	90	70	50	40
Reduction, %	10	20	0	0
Withdrawal, %	0	10	50	60
Cyclosporine				
No change, %	NA	50	50	0
Reduction, %	NA	0	0	0
Withdrawal, %	NA	50	50	100
Mycophenolate				
No change, %	0	39	0	33
Reduction, %	0	6	0	0
Withdrawal, %	100	56	100	67
Azathioprine				

No change, %	NA	100	-	-
Reduction, %	NA	0	-	-
Withdrawal, %	NA	0	-	-
mTor inhibitor				
No change, %	50	0	0	0
Reduction, %	0	0	0	0
Withdrawal, %	50	100	100	100
Belatacept				
No change, %	NA	-	-	-
Reduction, %	NA	-	-	-
Withdrawal, %	NA	-	-	-
Prednisone				
No change, %	70	58	29	20
Reduction, %	0	0	0	0
Increase, %	30	42	71	80
Anti TNF A				
No change, %	NA	-	-	-
Reduction, %	NA	-	-	-
Withdrawal, %	NA	-	-	-
Rituximab				
No change, %	NA	-	-	-
Reduction, %	NA	-	-	-
Withdrawal, %	NA	-	-	-
Cyclophosphamide				
No change, %	NA	-	-	-
Reduction, %	NA	-	-	-
Withdrawal, %	NA	-	-	-

Continuous variables are reported as mean ± SD or median (IQR). Abbreviations: ACE, angiotensin converting enzyme; ARB, angiotensin receptor blocker; COVID-19, corona virus disease 2019; ICU, intensive care unit; mTOR, mammalian target of rapamycin; NA, not applicable; TNF, tumor necrosis factor.

Follow-up data for patients on dialysis with COVID-19

According to hospital status

Table 6.

	Not admitted to hospital (n=7)	Admitted to hospital, no ICU (n=9)	Admitted to ICU (n=1)	Deceased (n=1)
Continuing KRT during admission, %	NA	100	100	100
Increase in intensity KRT, %	NA	0	0	0
Reason for discontinuation KRT				
No indication, %	NA	-	-	-
Logistical reasons related to COVID-19, %	NA	-	-	-
Patient/family preferred no admission, %	NA	-	-	-
Prognosis was too bad, %	NA	-	-	-
Organ dysfunction				
Liver (transaminases > 2 times ULN), %	NA	11	-	100
Heart (heart failure/new ECG abn), %	NA	0	-	0
Antiviral therapy, %	NA	33	-	100
(Hydroxy)chloroquine , %	NA	100	-	-
Lopinavir/ritonavir, %	NA	67	-	100
Remdesevir, %	NA	0	-	-
Interferon, %	NA	0	-	-
Other, %	NA	50	-	-
Anti-inflammatory therapy, %	NA	11	-	0
Tocilizumab, %	NA	0	-	0
Anakinra, %	NA	0	-	0
High dose steroids, %	NA	0	-	0
Other, %	NA	100	-	0
ACE-inhibitor use, %	NA	100	-	-
Continued, %	NA	0	-	-
Discontinued, %	NA	100	-	-
Replaced by ARB, %	NA	0	-	-
ARB use, %	NA	-	-	-
Continued, %	NA	-	-	-
Discontinued, %	NA	-	-	-

Continuous variables are reported as mean ± SD or median (IQR). Abbreviations: ACE, angiotensin converting enzyme; ARB, angiotensin receptor blocker; COVID-19, corona virus disease 2019; ICU, intensive care unit; NA, not applicable.

COVID-19 positive KRT patients

Outcome

Table 7.

	Kidney transplant patients (n=43)	Dialysis patients (n=10)	Missing data (n)
Status			14/4
Alive, %	82	83	
Deceased, %	18	17	
Lost to follow-up, %	0	0	
Specification alive			36/5
Transferred to another hospital, %	0	0	
Transferred to a nursing home, %	0	0	
Discharged to home, %	100	100	
Cause of death related to COVID-19, %	100	100	44/9

Continuous variables are reported as mean ± SD or median (IQR). Abbreviations: COVID-19, corona virus disease 2019; ICU, intensive care unit; NA, not applicable.