Characteristics and Outcomes of Kidney Transplant Patients Hospitalized for COVID-19 in the United States

Poster # 859

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Conclusions

- In this cohort of kidney transplant patients hospitalized for COVID-19, one-third of the patients did not receive any COVID-19 treatment
- Despite notable increase in mortality among patients with higher CKD stages, the use of COVID-19 treatments was lower with higher CKD stage
- Impaired renal function (without dialysis treatment), higher CCI scores and higher baseline supplemental oxygen requirements were associated with an increased risk of all-cause mortality
- This study sheds light on a persistent therapeutic gap that has affected these patients historically, attributed to factors such as potential drug interactions, uncertainties regarding the renal clearance of therapeutics that are no longer in effect since the label update for remdesivir in July 2023, and existing gaps in medical education and awareness

Background

- Chronic kidney disease (CKD) affects both the innate and adaptive immune systems[1]
- Transplant-related immunosuppression improves graft survival but increases the patients' susceptibility to infection[2]
- Solid organ transplant recipients receiving immunosuppressive therapy are widely considered at increased risk for severe COVID-19 and other adverse outcomes[3]
- NIH guideline recommendations include the use of remdesivir, dexamethasone, tocilizumab, baricitinib and anticoagulation among transplant COVID-19 patients[3]
- There is a knowledge gap in treatment options and mortality risk in post-transplant CKD patients
- The aim of the study was to explore treatment options and mortality in CKD post-transplant patients hospitalized with COVID-19 considering the intersection of risk factors

References:

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4. Remdesivir (Veklury) [package insert]. Food and Drug Administration. 2023. Available at: https://www.accessdata.fda.gov/drugsatfda_docs/label/2023/214787s019lbl.pdf.

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Methods

Study Design

- Retrospective cohort study
- Data source: Premier Healthcare inpatient chargemaster data
  - Administrative all-payer database
  - ~25% of all US hospitalizations
  - Covering 48 states

Inclusion criteria	✓ First admission to the hospital May 1, 2020-Jan 31, 2023 ✓ Age ≥18 years old ✓ Patients hospitalized with COVID-19 (ICD-10-CM: U07.1) and kidney transplant status (ICD-10-CM: Z94.0)
Exclusion criteria	✕ Pregnant ✕ Had incomplete data

Statistical analysis

- Descriptive analyses:
  - Demographics
  - COVID-19 disease severity at baseline: maximal level of oxygenation support within the first two days of admission
  - Chronic kidney disease (CKD) severity (renal allograft function)
  - COVID-19 treatments
  - Immunosuppressant treatments including for transplant
- Clinical outcomes
  - All-cause mortality by
    - CKD stages & Charlson Comorbidity Index (CCI)
    - Baseline oxygen support (COVID-19 disease severity)
    - COVID-19 treatment regimens
  - Hospital length of stay (LOS) Intensive care unit (ICU) LOS

Results

Study population

- 8,266 patients with history of kidney transplant were hospitalized for COVID-19 in 834 US hospitals during May 2020-Jan 2023 **(Table 1)**
- Mean age 60 years (± 13); 40% female; 55% White, 71% had Medicare as the primary payor **(Table 1)**
- Frequently reported comorbidities: hypertension (90%), diabetes mellitus (60%), obesity (23%) and congestive heart failure (26%) **(Table 1)**
- Median Charlson Comorbidity Index (CCI) of 4 **(Table 1)**

Severity and treatment

- The most common categories of severity for CKD were No CKD (34%), CKD stage 3 (23%), end stage renal disease (18%) and unspecified CKD stage (13%) **(Table 2)**
- Most patients did not have supplemental oxygen charges (NSOc) (57%), followed by low-flow (LFO) (17%), high-flow/non-invasive ventilation (HFO/NIV) (13%), invasive mechanical ventilation/ECMO (IMV/ECMO) (13%) **(Table 2)**
- Most frequently administered treatments included remdesivir (RDV)+dexamethasone (DEX) (27%), DEX monotherapy (24%), RDV monotherapy (10%) **(Table 2)**
- The majority of patients received CNI (81%), MMF (52%) as immunosuppressants **(Table 2)**
- Proportion of patients not receiving COVID-19 treatments i.e., neither RDV, DEX, baricitinib (BARI) nor tocilizumab (TOCI) was higher among those with higher CKD stage **(Figure 1)**
- Further, the proportion of patients receiving RDV monotherapy or in combination was lower among those with higher CKD stage **(Figure 1)**

Mortality and outcomes

- 29% were admitted to ICU during the hospitalization; the median hospital LOS and the median ICU LOS were each 5 days **(Table 2)**
- The unadjusted overall mortality rate was 15% **(Table 2)**
- Mortality by baseline oxygen support increased from 9% for NSOc to 57% for IMV/ECMO **(Figure 2)**
- Mortality by stage of CKD was lowest for no CKD (11%) and Stage ≤2 (14%); it was highest for CKD stage 4 (22%) and CKD stage 5 (21%) **(Figure 2)**
- Mortality by CCI categories increased from 8% among those with CCI≤2 to 31% among those with CCI 8+ **(Figure 2)**

Results

Table 1. Demographic and clinical characteristics of COVID-19 patients with a history of renal transplant, May 2020-Jan 2023

		N	%
# of Patients		8266	
# of Hospitals		834	
Age	Mean ± SD	60.5 ± 13.0	
Age Group	18-34	343	4%
	35-49	1258	15%
	50-64	3137	38%
	65+	3528	43%
Race	White	4537	55%
	Black	2220	27%
	Asian	364	4%
	Other	1145	14%
Gender	Female	3341	40%
Primary Payor	Commercial	1560	19%
	Medicare	5849	71%
	Medicaid	621	8%
	Other Payor	236	3%
Comorbidities (if prevalent ≥5%)	Hypertension	7453	90%
	Obesity	1871	23%
	COPD	1174	14%
	Renal disease	8266	100%
	Diabetes	4948	60%
	Congestive Heart Failure	2172	26%
	Myocardial Infarction	955	12%
	Cerebrovascular disease	381	5%
CCI	Median (IQR)	4 [3 - 5]	
	<=2	1718	21%
	3	1506	18%
	4	1516	18%
	5	1629	20%
	6	1047	13%
	7	478	6%
	8+	372	5%

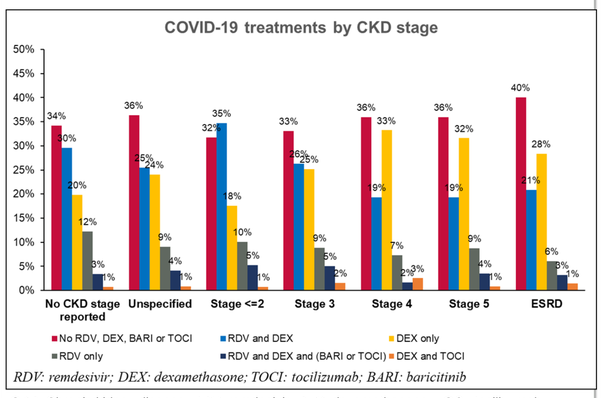
COPD: Chronic Obstructive Pulmonary Disease; CCI: Charlson Comorbidity Index

Table 2. Disease severity, treatment utilization and clinical outcomes of COVID-19 patients with a history of renal transplant, May 2020-Jan 2023

		N	%
# of Patients		8266	
# of Hospitals		834	
Treatment and Severity			
Severity of disease	CKD stage 1 or 2	250	3%
	CKD stage 3	1909	23%
	CKD stage 4	572	7%
	CKD stage 5	107	1%
	ESRD	1513	18%
	Unspecified	1102	13%
	No diagnosis code for CKD	2813	34%
Baseline oxygenation support (first two days of hospitalization)	IMV/ECMO	383	5%
	HFO/NIV	826	10%
	LFO	1400	17%
	NSOc	5657	68%
COVID-19 treatments (non-exclusive categories)	RDV	3483	42%
	Corticosteroids (including dexamethasone)	7269	88%
	Dexamethasone	4708	57%
	Dexamethasone AND/OR Methyl Prednisolone	5122	62%
	Anticoagulants	3689	45%
	Convalescent plasma	475	6%
	Tocilizumab	362	4%
COVID-19 treatments (mutually exclusive categories)	RDV and DEX (No BARI or TOCI)	2262	27%
	DEX only (No RDV or BARI or TOCI)	1951	24%
	RDV only (No Dex or BARI or TOCI)	862	10%
	RDV and DEX and either of (BARI or TOCI)	324	4%
	DEX and TOCI (no RDV or BARI)	100	1%
	None of the treatments among RDV, DEX, BARI or TOCI	2767	33%
Immunosuppressant (during hospitalization)	MMF	4290	52%
	CNI	6692	81%
	mTOR inhibitors	147	2%
Outcome			
Unadjusted Outcomes	All-cause mortality rate (%)	1263	15%
	LOS, median (IQR)	5 [3 - 10]	
	ICU stay (%)	2419	29%
	ICU LOS among those that used ICU, median (IQR)	5 [2 - 10]	

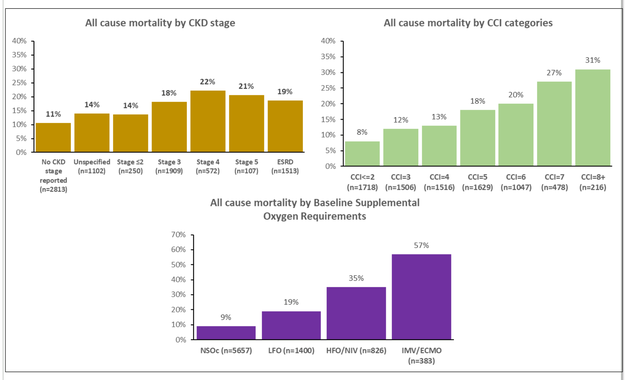
LOS: length of stay, ICU: intensive care unit, NSOc: no supplemental oxygen charges, LFO: low-flow oxygen, HFO/NIV: high-flow oxygen/non-invasive ventilation, IMV/ECMO: invasive mechanical ventilation/ECMO, CNI: calcineurin inhibitors, MMF: mycophenolate mofetil, CKD: Chronic Kidney Disease, RDV: remdesivir, DEX: dexamethasone, BARI: baricitinib, TOCI: tocilizumab, ICD-10 codes used to identify chronic kidney disease stages, stage 1 N18.1, stage 2 N18.2, stage 3 N18.3, stage 4 N18.4, stage 5 N18.5, ESRD N18.6, unspecified stage N18.9

Figure 1. COVID-19 treatment by CKD stage, May 2020-Jan



CKD: Chronic kidney disease, RDV: remdesivir, DEX: dexamethasone, TOCI: tocilizumab, BARI: baricitinib

Figure 2. All-cause mortality stratified by CKD stage, CCI and baseline supplemental oxygen requirements



CKD: Chronic kidney disease, CCI: Charlson Comorbidity Index, NSOc: no supplemental oxygen charges, LFO: low-flow oxygen, HFO/NIV: high-flow oxygen/non-invasive ventilation, IMV/ECMO: invasive mechanical ventilation/ECMO, CNI: calcineurin inhibitors, MMF: mycophenolate mofetil, RDV: remdesivir, DEX: dexamethasone, TOCI: tocilizumab, BARI: baricitinib