Procalcitonin and D-dimer levels at baseline, but not CRP, were informative of COVID-19 hospitalization outcomes

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INTRODUCTION & GOALS

- The WHO estimated 512 million cases of COVID-19 and 6.2 million deaths globally as of May 4th, 2022[1]
- As of October 3rd, 2022, estimates increased to 615 million cases and 6.5 million deaths[1]
- In Michigan (MI) the first case was diagnosed March 10th, 2020[3]
- We describe here outcomes of COVID-19 patients cared for in a large tertiary hospital in 2020 spanning two surges based on baseline lab values for C-reactive protein (CRP), Procalcitonin (PC), and D-Dimer (DD)

MATERIALS & METHODS

- Adult non-pregnant patients diagnosed via PCR with COVID-19 during the two surges in 2020 and admitted to Beaumont Hospital, Royal Oak, an 1,131 beds tertiary care referral center in MI, were reviewed
- Demographic, clinical and laboratory characteristics were obtained from the EMR
- ICD-10 classification diagnoses were utilized to identify comorbidities, and patient BMIs were based on the admission values in the EMR
- Outcomes were defined as death during current admission, transfer to nursing home or other facility, or discharge home
- Using a tree-based model and the combined levels of the three labs, we defined a hierarchy of four lab levels, each progressively having increased risk of death
- We then analyzed the outcome for the four levels, adjusting for time period (surge), age, sex, race, BMI and comorbidities
- Data was analyzed using SAS statistical software version 9.4 (SAS Institute).
- Beaumont Health IRB approved this study

RESULTS

- A total of 2197 patients were identified from March through December 2020, of whom 1118 had CRP, PC and DD available at baseline
- The mean age was 66.7 years (SD 16.1) for the cohort in first surge (March-June), and 66.4 (15.6) in the latter surge (July-December, Table1)
- More patients had a PC of >0.5 in the first surge (25.7%) than the second (13.2%)
- After adjusting for all other factors, the hierarchical lab levels are significantly associated with outcomes:
  - Baseline CRP value was not informative
  - Compared to the 2nd level (Table 2), the lowest level (PC < 0.1) has significantly lower odds of death [OR=0.37, 95% CI (0.19, 0.73)], while the highest level, (DD >1000 and PC ≥ 0.26) has significantly higher odds of death [OR=3.01, 95% CI (1.59, 5.72)]

TABLE1. COVID 19 patients with complete lab data

Patient Characteristics

Admission period	Jan '20 - Jun '20		Jul '20 - Dec '20	
N	525		593	
Age, Mean & SD	66.7	16.1	66.4	15.6
Sex				
Female	249	47.4%	241	40.6%
Male	276	52.6%	352	59.4%
Race *(Missing, n=2)*				
Black	237	45.1%	118	19.9%
White	233	44.4%	377	63.6%
Other	55	10.5%	96	16.2%
BMI categories				
Underweight (<18.5)	14	2.7%	6	1.0%
Healthy weight (18.5 - 24.9)	114	21.7%	108	18.2%
Overweight (25.0 - 29.9)	142	27.0%	161	27.2%
Obesity (≥30.0)	231	44.0%	311	52.4%
Missing	24	4.6%	7	1.2%
Comorbidities				
Cardiac	312	59.4%	294	49.6%
Diabetes	126	24.0%	130	21.9%
Pulmonary	92	17.5%	94	15.9%
Neurologic	52	9.9%	38	6.4%
Cancer	90	17.1%	94	15.9%
Renal	64	12.2%	59	9.9%
Lab data available				
CRP				
Mild *(<9)*	21	4.0%	62	10.5%
Moderate *(≥9, <100)*	230	43.8%	331	55.8%
High *(≥100)*	274	52.2%	200	33.7%
DDimer				
Mild *(<500)*	67	12.8%	130	21.9%
Moderate *(≥500, <1000)*	173	33.0%	229	38.6%
High *(≥1000)*	284	54.1%	234	39.5%
Procalcitonin				
Antibiotics strongly discouraged *(<0.1)*	152	29.0%	307	51.8%
Antibiotics discouraged *(≥0.1, ≤0.25)*	151	28.8%	159	26.8%
Antibiotics encouraged *(≥0.26, ≤0.5)*	87	16.6%	49	8.3%
Antibiotics strongly encouraged *(>0.5)*	135	25.7%	78	13.2%

TABLE 2. Analysis of COVID 19 hospitalizations

		Final Outcome - Rates			Final Outcome - Adjusted Odds Ratios & 95% CI			
			Transf to					
	N	Died	Sk Fac	Home	Died		Transfer to Sk Fac	
Overall rate	1118	15.1%	18.7%	66.2%				
Lab marker level*								
A	459	5.4%	14.2%	80.4%	0.37	(0.19, 0.73)	0.57	(0.33, 1.00)
B *(ref)*	143	15.4%	28.7%	55.9%	1.00		1.00	
C	290	16.2%	15.9%	67.9%	1.15	(0.61, 2.18)	0.67	(0.38, 1.19)
D	226	33.2%	25.2%	41.6%	3.01	(1.59, 5.72)	1.18	(0.65, 2.14)
Time period								
Jan - Jun	525	20.6%	28.4%	51.0%	3.14	(2.05, 4.81)	4.93	(3.31, 7.34)
Jul - Dec *(ref)*	593	10.3%	10.1%	79.6%	1.00		1.00	
Age, Mean & SD		75.6, 12.6	74.1, 13.5	62.3, 15.4	1.09	(1.07, 1.11)	1.06	(1.04, 1.08)
Sex								
Female *(ref)*	490	13.7%	19.2%	67.1%	1.00		1.00	
Male	628	16.2%	18.3%	65.4%	1.41	(0.94, 2.12)	1.33	(0.92, 1.94)
Race *(Missing, n=2)*								
Black	355	17.2%	19.4%	64.2%	0.95	(0.60, 1.52)	0.76	(0.49, 1.16)
White *(ref)*	610	13.4%	20.2%	66.4%	1.00		1.00	
Other	151	17.2%	11.3%	71.5%	1.55	(0.87, 2.76)	0.65	(0.35, 1.21)
BMI categories								
Underweight (<18.5)	20	25.0%	50.0%	25.0%	1.92	(0.44, 8.33)	2.59	(0.71, 9.39)
Healthy wt (18.5 - 24.9) *(ref)*	222	15.3%	27.9%	56.8%	1.00		1.00	
Overweight (25.0 - 29.9)	303	16.5%	15.8%	67.7%	1.47	(0.84, 2.59)	0.76	(0.46, 1.26)
Obesity (≥30.0)	542	14.2%	14.0%	71.8%	2.12	(1.22, 3.70)	0.89	(0.55, 1.45)
Missing	31	9.7%	41.9%	48.4%	*left missing BMI out of model*			
Comorbidities *(ref for each is 'No')*								
Cardiac	606	19.3%	22.6%	58.1%	1.42	(0.90, 2.23)	1.19	(0.79, 1.80)
Diabetes	256	16.8%	24.2%	59.0%	1.02	(0.64, 1.63)	1.58	(1.03, 2.43)
Pulmonary	186	16.7%	22.6%	60.8%	1.30	(0.76, 2.21)	1.51	(0.94, 2.41)
Neurologic	90	23.3%	36.7%	40.0%	1.65	(0.85, 3.20)	2.17	(1.21, 3.87)
Cancer	184	17.4%	19.0%	63.6%	0.80	(0.48, 1.35)	0.63	(0.38, 1.03)
Renal	123	25.2%	27.6%	47.2%	1.30	(0.74, 2.29)	1.34	(0.77, 2.32)

* Marker levels (PC=Procalcitonin, DD=DDimer)
A PC<0.1
B 0.1≤PC≤0.25, DD≥1000
C PC≥0.1, DD<1000
D PC>0.25, DD≥1000

Assessing any differences in those who had baseline labs

Addressing IDWeek Reviewer's comment about differences between pts w/ and w/o key labs

Comparison of periods of admission	Jan '20 - Jun '20					Jul '20 - Dec '20				
	1151					1046				
CRP, DDimer and Procalcitonin *(48hr)*	Yes		No			Yes		No		
	525	45.6%	626	54.4%	*p-value*	593	56.7%	453	43.3%	*p-value*
Age										
Mean, SD	66.7	16.1	67.0	17.2	*0.488*	64.4	15.6	63.0	18.6	*0.008*
Sex					*0.144*					*<0.001*
Female	249	47.4%	324	51.8%		241	40.6%	235	51.9%	
Male	276	52.6%	302	48.2%		352	59.4%	218	48.1%	
Race	*(Missing, n=2)*				*0.002*	*(Missing, n=2)*				*0.042*
Black	237	45.1%	350	55.9%		118	19.9%	117	25.8%	
White	233	44.4%	215	34.3%		377	63.6%	283	62.5%	
Asian	14	2.7%	13	2.1%		17	2.9%	12	2.6%	
Other	41	7.8%	46	7.3%		79	13.3%	41	9.1%	
BMI	*(Missing, n=47)*					*(Missing, n=20)*				
Mean, SD	30.9	9.1	30.5	7.8	*0.967*	31.7	7.9	30.0	7.9	*<0.001*
Comorbidities										
Cardiac	312	59.4%	331	52.9%	*0.026*	294	49.6%	219	48.3%	*0.692*
Diabetes	126	24.0%	162	25.9%	*0.464*	130	21.9%	89	19.6%	*0.370*
Pulmonary	92	17.5%	92	14.7%	*0.192*	94	15.9%	58	12.8%	*0.166*
Neurologic	52	9.9%	53	8.5%	*0.399*	38	6.4%	27	6.0%	*0.766*
Cancer	90	17.1%	98	15.7%	*0.496*	94	15.9%	70	15.5%	*0.860*
Renal	64	12.2%	83	13.3%	*0.589*	59	9.9%	37	8.2%	*0.323*

CONCLUSIONS

Baseline PC and DD, but not CRP, were informative in determining risk of death and can assist clinicians determine possible outcomes during COVID-19 hospitalization

REFERENCES

1. WHO COVID 19 Dashboard: https://covid19.who.int/. Last accessed 10/3/2022
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