Central Line Audit Team: RNs Who Monitored Central Lines in COVID ICUs in An Acute Care Hospital in NYC

Results: Central line rounds performed after the intervention showed a great improvement in compliance with the central line maintenance bundle, from 13% during the first rounds performed in April, to 88% in May, less than a month after these rounds started. Since this intervention, the ICU CLABSI rate has decreased from a rate of 3.3 per 1,000 central line days in April and May to a current rate of 0.

Conclusion: The timely identification and root cause analysis of a problem must be followed by timely, intensive, and repeated interventions that are designed to attack the causes of problems at their source. After the crisis period is over, the interventions must be maintained to ensure that gains made can be sustained.

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506. Variation in Occupational Activities and Infection Prevention Practices in Healthcare Personnel Based on Exposure to COVID-19 Units

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Session: P-17. COVID-19 Infection Prevention

Background: Healthcare personnel (HCP) may be at increased risk for COVID-19, but differences in risk by work activities are poorly defined. Centers for Disease Control and Prevention recommends cohorting hospitalized patients with COVID-19 to reduce in-hospital transmission of SARS-CoV-2, but it is unknown if occupational and non-occupational behaviors differ based on exposure to COVID-19 units.

Methods: We analyzed a subset of HCP from an ongoing CDC-funded SARS-CoV-2 serosurveillance study. HCP were recruited from four Atlanta hospitals of different sizes and patient populations. All HCP completed a baseline REDCap survey. We used logistic regression to compare occupational activities and infection prevention practices among HCP stratified by exposure to COVID-19 units: low (0% of shifts), medium (1–49% of shifts) or high (≥50% of shifts).

Results: Of 211 HCP enrolled (36% emergency department [ED] providers, 35% inpatient RNs, 17% inpatient MDs/APPs, 7% radiology technicians and 6% respiratory therapists [RTs]), the majority (79%) were female and the median age was 35 years. Nearly half of the inpatient MD/APPs (46%) and RNs (47%) and over two-thirds of the RTs (67%) worked primarily in the ICU. Aerosol generating procedures were common among RNs, MD/APPs, and RTs (26–58% performed ≥1), but rare among ED providers (0–13% performed ≥1). Compared to HCP with low exposure to COVID-19 units, those with medium or high exposure spent a similar proportion of shifts directly at the bedside and were about as likely to practice universal masking. Being able to consistently social distance from co-workers was rare (33%); HCP with high exposure to COVID-19 units were less likely to report social distancing in the workplace compared to those with low exposure; however, this was not significantly different (OR 0.6; 95% CI: 0.3, 1.1). Concerns about personal protective equipment in COVID-19 units were similar across levels of exposure (Table 1).

Table 1: Occupational activities and infection prevention behaviors of healthcare personnel stratified by level of exposure to COVID-19 units

Table 1: Occupational activities and infection prevention behaviors of healthcare personnel stratified by level of exposure to COVID-19 units

Variable[1]	Level of exposure to COVID-19 units[2]					Total
	Low (n = 73)	Medium (n = 41)		High (n = 95)		(n = 211)
	(n (%))	(n (%))	OR (95% CI)[3,4]	(n (%))	OR (95% CI)[3,4]	(n (%))
Occupation						
Emergency room provider	35 (48)	18 (44)	–	24 (25)	–	77 (36)
Inpatient MD/APP	14 (19)	6 (15)	0.7 (0.2, 2.0)	13 (14)	0.7 (0.3, 1.5)	35 (17)
Inpatient RN	17 (23)	14 (34)	1.7 (0.7, 4.0)	42 (44)	2.6 (1.3, 5.2)*	73 (35)
Respiratory therapist	3 (4)	1 (2)	0.6 (0.0, 4.7)	8 (8)	2.1 (0.6, 10.1)	12 (6)
Radiology technician	4 (5)	2 (5)	0.9 (0.1, 4.7)	8 (8)	1.6 (0.5, 6.1)	14 (7)
Proportion of shifts spent directly at bedside						
Low (≤ 50%)	25 (34)	16 (39)	–	30 (32)	–	71 (34)
High (> 50%)	48 (66)	25 (61)	0.8 (0.4, 1.8)	65 (68)	1.1 (0.6, 2.2)	138 (66)
Able to consistently social distance from co-workers	29 (40)	15 (37)	0.9 (0.4, 1.9)	26 (27)	0.6 (0.3, 1.1)	70 (33)
Practicing universal masking nearly all the time at work	58 (79)	31 (76)	0.8 (0.3, 2.0)	71 (75)	0.8 (0.4, 1.6)	160 (77)
Had concerns about PPE use while in COVID-19 units[5]	0 (0)	8 (20)	–	25 (27)	1.5 (0.6, 3.9)	33 (25)
Goes shopping outside home	65 (89)	36 (88)	0.9 (0.3, 3.1)	79 (83)	0.6 (0.2, 1.5)	181 (86)

[1] All questions about occupational activities refer to the last 2 weeks
[2] Low: no shifts spent in COVID-19 cohorted units, Medium: more than none but less than half of shifts spent in COVID-19 cohorted units, High: half or more of shifts spent in COVID-19 cohorted units; information was missing for 2 participants
[3] Logistic regression was used to examine associations between level of exposure to COVID-19 cohorted units and variables; * = significant associations
[4] The reference group is "Low" exposure to COVID-19 cohorted units for all variables *except* "Had concerns about PPE use while in COVID-19 units", for which the reference group is "Medium" exposure to COVID-19 cohorted units
[5] Only asked for participants who worked at least some shifts in COVID-19 units (n = 136); percentages calculated with denominators equal to only participants who were asked the question

Abbreviations: OR, odds ratio; CI, confidence interval; MD, doctor of medicine; APP, advanced practice provider; RN, registered nurse; IQR, interquartile range; PPE, personal protective equipment

Conclusion: The proportion of time spent in dedicated COVID-19 units did not appear to influence time HCP spend directly at the bedside or infection prevention practices (social distancing and universal masking) in the workplace. Risk for SARS-CoV-2 infection in HCP may depend more on factors acting at the individual level rather than those related to location of work.

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507. Activation of Macrophages Enhances Susceptibility to SARS-CoV-2 Antibody-Dependent Enhancement and Promotes Damage to Downstream Epithelial Cells

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Session: P-18. COVID-19 Pathogenesis

Background: The distinct shift in peripheral monocyte activation and infiltration of these cells into the respiratory tract observed in severe cases of COVID-19 suggests that like SARS-CoV-1, the acute respiratory distress syndrome (ARDs) observed in SARS-CoV-2 infections may result from damage to the respiratory epithelia by improperly activated macrophages (MPs). In this study, we examined the ability of non-neutralizing antibodies to sensitize MPs to killing by SARS-CoV-2, as well as the impact of these cells on downstream epithelial cells.

Methods: Raw 264.7 cells were seeded into 96-well plates at a density of $1x10^4$/well and incubated overnight in the presence or absence of heat-inactivated LPS derived from either *E. coli* (EC) or *S. enteritidis* (Sal). Cells were then treated with non-neutralizing antibodies or vehicle control at the time of infection with SARS-CoV-2. Viability was assessed 48 hours post-infection by luminescence following the addition of CellTiter-Glo® (Promega).

Results: While no decrease in cell viability was observed with SARS-CoV-2 alone, the presence of non-neutralizing antibodies against either the nucleocapsid or spike protein of SARS-CoV-2 decreased cell survival to 35.98% and 53.67% of the cell control, respectively ($p< 0.0001$ and $p=0.0003$). Activation of MPs with Sal-derived LPS sensitized MPs to viral killing, even in the absence of non-neutralizing antibody (20.12% viability, $p< 0.0001$). This was not observed in MPs activated by EC LPS. MP activation by both Sal and EC LPS further enhanced viral killing in the presence of anti-nucleocapsid, reducing cell viability to 12.21% (0.0001) and 6.46% ($p< 0.0001$). Finally, supernatants collected from naïve MPs subjected to ADE markedly increased the susceptibility of Vero E6 cells to SARS-CoV-2 nearly 9.8-fold ($p< 0.0001$).

Conclusion: Here we demonstrate that naïve MPs, normally resistant to infection by SARS-CoV-2, are rendered susceptible to viral killing by activation and the presence of non-neutralizing antibodies to SARS-CoV-2. Furthermore, MPs secrete an as yet, unknown factor that enhances the susceptibility of Vero E6 to SARS-CoV-2. Taken together, these data suggest that MPs play an important role in determining the severity of SARS-CoV-2 infection.

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508. Biomarker elevation during COVID-19: Differences between ambulatory and hospitalized individuals

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Epidemiology, Immunology and Clinical Characteristics of Emerging Infectious Diseases with Pandemic Potential (EPICC) Study Group

Session: P-18. COVID-19 Pathogenesis

Background: While the majority of illness due to COVID-19 does not require hospitalization, little has been described about the host inflammatory response in the ambulatory setting. Differences in the levels of inflammatory signaling proteins between outpatient and hospitalized populations could identify key maladaptive immune responses during COVID-19.

Methods: Samples were collected from 76 participants (41% female, mean 46.8 years of age) enrolled at five military treatment facilities between March 20, 2020 and June 17, 2020 in an ongoing prospective COVID-19 cohort. This analysis was restricted to those with positive SARS-CoV-2 (severe acute respiratory syndrome–coronavirus 2) RT-PCR testing and included hospitalized (N=29; 10 requiring an ICU stay) and non-hospitalized (N=43) participants. Severity markers (IL6, D-dimer, procalcitonin, ferritin, ICAM-1, IL5, lipocalin, RAGE, TNFR, VEGFA, IFNγ, IL1β) were measured in plasma (mg/dL) using the Ella immunoassay and natural log transformed. Univariate negative binomial regression was performed to determine relative risk of hospitalization. Using the full marker panel, we performed a Principal Component Analysis (PCA) to determine directions of maximal variance in the data. Pearson's correlation coefficient was determined between analytes and each axis.

Results: Participants requiring ambulatory-, hospital-, and ICU-level care had samples collected at 44.0 (IQR: 35.0–51.0), 40.0 (13.0–51.0), and 47.5 (21.0–54.0) days, respectively. Higher unadjusted levels of IL6, D-dimer, procalcitonin, or ferritin were each associated with hospitalization (Table 1). The PCA showed a separation along axes between level of care and duration of symptoms (Fig 1). While significant correlations were noted with a number of biomarkers, PC1 most correlated with TNFR1 (r=0.88) and PC2 most correlated with IL6Ra (r=0.95). PC1 axis variation accounted for 36.5% of variance and the PC2 axis accounted for 20.0% of variance.

Figure 1. Principal Component Analysis (PCA) of biomarkers by level of care and symptom duration.

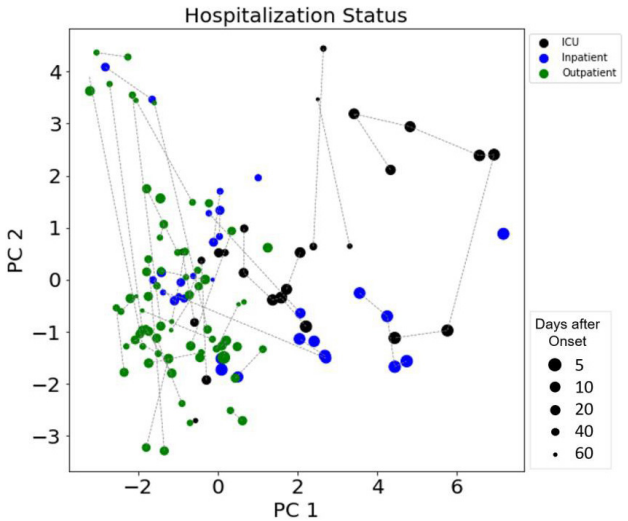

Table 1. Inflammation biomarker levels between level of care requirements.

Biomarker analyte (units)	Ambulatory care (median, IQR) (pg/mL)	Required hospitalization (median, IQR) (pg/mL)	Received ICU care (median, IQR) (pg/mL)	RR of hospitalization (95% CI) (per natural log pg/ml)
D-dimer	313,489 (193,814-652,718)	891,014 (479,005-1.8e+06)	964,282 (611,300-1.5e+06)	1.72 (1.2, 2.4)
IL6	1.2 (0.7-1.7)	2.4 (2.0-6.4)	4.5 (2.1-17.5)	1.5 (1.2, 1.8)
Ferritin	76,430 (22,431-169,441)	188,417 (64,865-450,179)	270,657 (111,496-601,828)	1.33 (0.99, 1.8)
Procalcitonin	46.5 (33.3-80.6)	69.4 (40.1-99.8)	139.5 (67.9-256.0)	1.37 (1.1, 1.8)

RR: relative risk; IQR: interquartile range

Conclusion: TNFR1 and IL6Ra levels correlated with differences in the proinflammatory states between hospitalized and non-hospitalized individuals including time points late in the course of illness. Further analysis of these preliminary findings is needed to evaluate for differences by stages of illness.

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509. Comparision of CD4+ T Cells in Patients with Severe vs Critical COVID -19

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INFECTOMED

Session: P-18. COVID-19 Pathogenesis

Background: Over the past few years, it has been shown that T cells play an essential role in antiviral immunity, in the course of the COVID-19 pandemic some studies reported an association between lymphocytopenia and exhaustion of the surviving remaining T cells which are apparently functional in patients with acute COVID-19, specially in those with severe forms of presentation. Some studies have reported an association where less than 800 CD4 + T cells are negatively related to the survival of seriously ill patients with COVID -19.

Methods: We included 19 patients admitted to our hospital (ABC Medical Center) from May 7 to 15, 2020 with a confirmed diagnosis of COVID-19 and were randomized into 2 groups according to the severity of the presentation (severe or critical) A determination of CD4 + T cells was made at admission, we also reported the need for invasive mechanical ventilation at some point of the hospitalization for each group, all patients were followed until their hospital discharge. One patient was excluded because he was still admitted at the time of the analysis.

Results: Of the 18 patients included, 9 (50%) fulfilled criteria of severe and 9 (50%) of critical. The mean of CD4 + T cell was 455 (256–697) for the severe and 285.44 (145–430) for the critical (CI 95% P 0.46), the determination of CD8+ T cell was 212 (88–392) for the severe and 201 (59–534) for the critical (CI 95% P 1.19), of the critical patients 8 (88.9%) required invasive mechanical ventilation and only one non-invasive mechanical ventilation, while the severe patients only required support with supplemental oxygen by nasal cannula (9 (100%)).The mean lenght of hospitalization was 12.73 days (3–34) and all the patients survived until they were discharged home.

Conclusion: As it has been reported in some studies, the pathogenesis of SARS-CoV-2 infection in humans is associated with a reduction and functional exhaustion of T cells in patients with COVID-19.In this study we presume that lower levels of CD4+T cells can be associated with critical forms of COVID 19 as the majority of critical patients in our report had < 300 CD4 +T cell count, while we need further studies with a greater number of patients and follow-up to establish reliable determinations, we propose than the levels of CD4+T cell count could be use as a good predictor of severity in COVID-19

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510. Elevated IL-1β level as a predictor of inflammation and death in COVID-19

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Session: P-18. COVID-19 Pathogenesis

Background: SARS-Cov-2 (severe acute respiratory disease coronavirus 2) causes Coronavirus Disease 2019 (COVID19) and is associated with respiratory failure and death in severe disease. This is associated with high levels of cytokines such as IL-6, IL-8 and TNF-alpha which are predictors of severe outcomes. SARS-CoV-2 leads to activation of the NLRP3 inflammasome which results in secretion of