Association between procalcitonin levels and *Clostridium difficile* infection

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BACKGROUND

- Elevation in procalcitonin (PCT) has been correlated to infections caused specifically by bacteria
- PCT levels have been used to assist in diagnoses and guidance of antibiotic therapy in respiratory tract infections as well as sepsis
- Rao K, et al. published the only study evaluating the association between PCT levels and *Clostridium difficile* infection (CDI) severity, which showed an association present with a PCT cutoff of 0.2 mcg/L

OBJECTIVE

- Determine the association between CDI and PCT
- Evaluate association between CDI severity and PCT
- Determine individual severity factors associated with increased PCT

ENDPOINTS

Primary endpoint:

- PCT in patients with completed CDI diagnostic tests

Secondary endpoints:

- PCT levels of patients with different severity levels
  - Mild-moderate: WBC <15,000 cells/μL and SCr <1.5x baseline
  - Severe: WBC ≥15,000 cells/μL or SCr >1.5x baseline
  - Severe, complicated: hypotension, shock, ileus, megacolon

METHODS

Retrospective chart review of Loma Linda University Medical Center's electronic medical records from January 1, 2013 to September 30, 2015.

Table 1. Patient Population

INCLUSION	EXCLUSION
❑ Suspected *Clostridium difficile* infection	❑ Younger than 18 years old or older than 89 years
❑ PCT level drawn on day of suspected CDI	❑ No PCT levels
	❑ Pregnant or incarcerated
	❑ Expired within 2 days of CDI diagnostic tests

Table 2. Baseline Characteristics

	On Admission			Day of Diagnostic Tests		
	Positive CDI (n=55)	Negative CDI (n=49)	P-value	Positive CDI (n=55)	Negative CDI (n=49)	P-value
Age (years)*	64 (19-89)	63 (18-89)	0.511	-	-	-
Males (n)(%)	25 (45%)	24 (49%)	0.844	-	-	-
Weight (kg)*	75.8 (44.5-163.1)	66.8 (28.4-129)	0.130	-	-	-
Height (cm)*	162.6 (15.2-185.4)	160 (15.2-185.4)	0.457	-	-	-
Highest temp (F)*	99 (97.2-104.1)	98.8 (97.6-104)	0.527	99.3 (97.2-104.1)	98.9 (97.6-104)	0.395
Lowest SBP (mmHg)*	102 (68-155)	108 (61-192)	0.532	98 (64-127)	100 (61-140)	0.625
Lowest DBP (mmHg)*	59 (25-89)	59 (28-93)	0.757	52 (16-77)	49 (21-82)	0.848
WBC (bil/L)*	14.34 (0.13-91.38)	12.76 (0.9-46.7)	0.147	16.45 (1.68-82.4)	12.72 (0.9-41.9)	0.027
SCr (mg/dL)*	0.95 (0.3-10.1)	1.2 (0.3-7.9)	0.198	1.15 (0.3-10.1)	1.05 (0.3-7.3)	0.453
Albumin (g/dL)*	3 (1.5-4.3)	3.2 (1.6-4.7)	0.087	2.6 (1.7-3.7)	3 (1.4-4)	0.137
Lactate (mmol/L)*	1.9 (0.6-10.5)	2.15 (0.6-8.7)	0.643	1.55 (0.2-8.2)	1.6 (0.6-6.8)	0.968
Procalcitonin (mcg/L)*	-	-	-	0.63 (0.02-73.29)	0.73 (0.07-178)	0.216
Other infections (n)(%)	48 (87%)	40 (82%)	0.587	-	-	-
Surgeries (n)(%)	6 (11%)	4 (8%)	0.746	-	-	-

SBP=systolic blood pressure, DBP=diastolic blood pressure, WBC=white blood cell, SCr=serum creatinine, CDI=*Clostridium difficile* infection, *=median (interquartile range)

Table 3. Correlation between CDI and log PCT

	r	r^2	P-value (2-tailed)
Pearson correlation	0.126	0.016	0.202

Figure 1. log PCT in CDI positive and negative

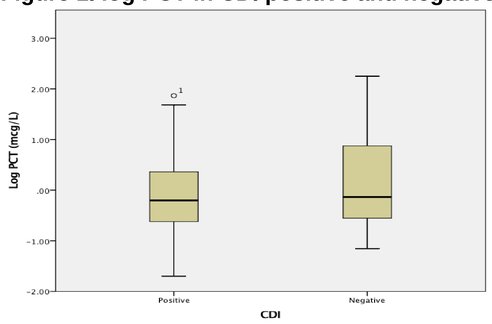


Table 4. Linear Regression

	Unstandardized coefficient	t	P-value	95% CI
CDI	0.358	2.02	0.047	0.01 to 0.71
Surgery	-0.027	-0.1	0.925	-0.6 to 0.54
Probiotics	0.006	0.02	0.983	-0.56 to 0.57
log WBC	0.356	1.33	0.188	-0.18 to 0.89
log SCr	0.653	2.48	0.015	0.13 to 1.18
Albumin	-0.097	-0.56	0.578	-0.44 to 0.25
Hypotension	-0.271	-1.53	0.129	-0.62 to 0.08
Invasive infection±	-0.482	-2.81	0.006	-0.82 to -0.14

WBC=white blood cell, SCr=serum creatinine, CDI=*Clostridium difficile* infection, ±=non urinary tract or uncomplicated skin infections

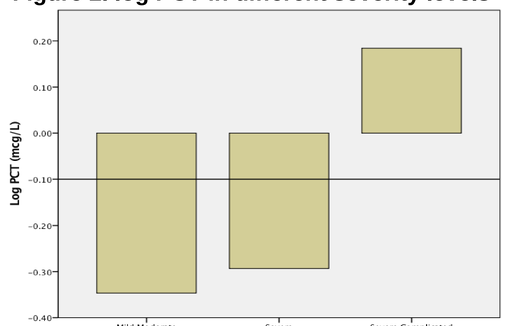
Table 5. Median PCT and ANOVA based on infection severity

	Mild-moderate(n=14)	Severe (n=12)	Severe, Complicated (n=29)
Median PCT (IQR)	0.44 (0.07-6.83)	0.4 (0.09-3.88)	1.05 (0.02-73.29)
ANOVA 2.922 (p=0.063)			

Table 6. Post Hoc test between severity levels

		Mean diff	P-value
Mild-moderate	Severe	-0.053	0.86
	Severe, complicated	-0.531	0.042
Severe	Mild-moderate	0.053	0.86
	Severe, complicated	-0.478	0.073

Figure 2. log PCT in different severity levels



CONCLUSION

- CDI demonstrated a small, positive effect on PCT
- Higher PCT levels were found with severe, complicated infections compared to mild-moderate infections
- Elevated PCT levels in both groups may be due to confounding factors (other bacterial infections, surgeries, etc)
- Further studies in patients with only CDI are needed to better assess the relationship between PCT and CDI

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