Use Risk Factors to Early Screen Pneumocystis Pneumonia in Hospitalized Patients



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BACKGROUND

- Pneumocystis pneumonia (PCP) often occurs in immunocompromised individuals.
- The diagnosis of PCP may be delayed or missed if the underlying risk factors are not recognized, particularly in non-HIV infected patients

OBJECTIVE

- To compare clinical characteristics of the patients with PCP between non-HIV and HIV infected groups
- To evaluate the risk factors for PCP in hospitalized patients with pneumonia
- To establish a model to predict the occurrence of PCP in the non-HIV infected patients with pneumonia.

METHODS

Data Source and Subject Selection

- Nationwide Inpatient Sample (NIS) 2005-2014
- Patients older than 18 years
- Pneumonia and PCP: Identified by ICD-9-CM codes

Groups

- PCP pneumonia group vs. non-PCP pneumonia group
- HIV infected group vs. non-HIV infected group

Outcomes

- Rates of PCP in hospitalized patients with pneumonia
- Clinical features and outcomes of patients with PCP
- Risk factors for PCP: Logistic regression
- Risk-adjusted predictive model of PCP for non-HIV infected patients
- § Using the identified risk factors
- § To predict the occurrence of PCP
- § Discriminant analysis

RESULT 1: Occurrence Rates of PCP

- patients with PCP.
- charge.
- (107,879 vs. 27,870).
- non-HIV infected group.

RESULT 2: Characterics of Patients with PCP

	Non-HIV Infected (n=27,870)	HIV Infected (n=107,879)				
Age (years) *	59.9±15.7	42.6±10.4				
Sex *						
Male	15,192 (54.5%)	76,231 (70.7%)				
Female	12,678 (45.5%)	31,639 (29.3%)				
Charlson Index *						
0-1	9,228 (33.1%)	84,526 (78.4%)				
2-3	12,161 (43.6%)	13,831 (12.8%)				
4-5	3,482 (12.5%)	2,184 (2%)				
≥ 6	2,999 (10.8%)	7,338 (6.8%)				
Mortality*	5,838 (21%)	10,200 (9.5%)				
Hospital stay (days) **	9 (0-254)	7 (0-226)				
Hospital charges (\$) ^{†*}	60,018 (130-2,807,110)	36,848 (120-263,7311)				
[†] Medium (range); * <i>P</i> <0.001						

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• A total of 24,025,696 patients with pneumonia were identified during the studied years, including 135,749

• Comparing the patients with pneumonia of other etiology, those with PCP were 22 years younger (46.2 ± 13.6 vs. 68.5 ± 16.9 years, p<0.001), had 1.4 times higher mortality (11.8% vs. 8.2, p<0.001), 3 days longer hospital stay and 1.5 times higher hospital

• In patients with PCP, the case number in HIV infected group was 3.9 times of that in non-HIV infected group

• In the patients with pneumonia, PCP shared 30.5% cases in HIV infected group, but only 0.12% cases in

The PCP patients in non-HIV infected group were older, had higher mortality, required longer hospital stay and higher hospital charge than those in HIV infected group.

RESULT	3: Risk for PCP		RESULT 4: Risk-Adjust	RESULT 4: Risk-Adjusted Predictive Mod	
• The risk factors for PC	P in the patients with pne	eumonia	• Model to predict PCP for non-HIV infected patients		
	OR	P value	Factors [†] :	Functions*:	
\mathbf{A} go (years) (Deference: 18.25)	(95% Confidence Interval)		Connective tissue disease (X_1)		
Age (years) (Reference: 10-33)	0.92(0.9,0.92)	<0.001	Lymphoma (X_2)	$PCP = 2.376 \text{ x } X_1 + 10.89 \text{ x}$ 2 678 x $Y_1 + 1.052 \text{ x } Y_2 + 2$	
30-43 16 55	0.82 (0.8-0.83)	< 0.001	$\mathbf{M}_{\text{otostatic concer}}(\mathbf{X})$	$2.0/8 \times A_3 + 1.955 \times A_4 + 5$ X + 2.07 x X + 8.262 x X	
40- <i>33</i> 56 65	0.00 (0.04-0.07)	< 0.001	$\sum_{i=1}^{n} \sum_{j=1}^{n} \sum_{i=1}^{n} \sum_{j=1}^{n} \sum_{i$	$A_5 + 3.07 \times A_6 + 3.202 \times A_7$ 4 478 x X ₂ + 5 471 x X ₂ + 8	
50-05 66-75	0.38 (0.37 - 0.0)	<0.001	Non-metastatic cancer (X_4) x X ₁₀ - 3.638		
>76	0.19 (0.18-0.2)	<0.001	CMV infection (X_5)		
Sex (Reference: Male)	0.17 (0.10 0.2)	<0.001	Inflammatory bowel disease (X_6)	No PCP = $0.996 \ge X_1 + 1.00$	
Female	0.85 (0.83-0.86)	<0.001	Immune thrombocytopenic purpura (X_7)	$X_2 + 1.12 \text{ x } X_3 + 1.104 \text{ x } X_2$	
Charlson Index (Reference: 0-1)	<0.001	Chronic steroid use(X_{x})	$0.566 \ge X_5 + 0.973 \ge X_6 + 0.$	
2-3	0 76 (0 74-0 78)	< 0.001	Solid organ transplant (\mathbf{X}_{n})	$X_7 + 0.813 \text{ x } X_8 + 0.99 \text{ x } X_9$	
<i>2-5</i> 4-5	0.7 (0.67-0.73)	<0.001	L cultornia (V)	$1.022 \text{ x } X_{10} - 0.782$	
> 6	0.34 (0.33-0.35)	<0.001	Sensitivity (95% CI^{Δ})	42 9% (42 3%-43 5%)	
Comorbidities (Reference: No event)			Sensitivity $(95\% \text{ CI}^{\Delta})$	94.4% (94.4% 94.4%)	
HIV infection	270.2 (264.5-276)	< 0.001	Bositive predictive value $(05\% \text{ CL}^{3})$		
Leukemia	7.99 (7.63-8.36)	< 0.001	Positive predictive value (95% C1 ²)	0.9% (0.9%-0.92%)	
Solid organ transplant	4.72 (4.39-5.08)	< 0.001	Negative predictive value (95% CI Δ)	99.9% (99.9%-99.9%)	
Chronic steroid use	3.78 (3.62-3.93)	< 0.001	Accuracy (95% CI [△])	94.3% (94.3%-94.4%)	
Metastatic cancer	3.3 (3.13-3.47)	< 0.001	[†] Occurrence of the risk factor is assigned a value of "1" whereas nonoccurrence i		
Lymphoma	3.03 (2.91-3.15)	< 0.001	assigned as "0"		
CMV infection	2.54 (2.44-2.64)	< 0.001	* The outcome predicted by the model is determined by the model by the model by the model is determined by the model	* The outcome predicted by the model is determined by which function was found have a higher score	
Stem cell transplant	2.17 (1.97-2.39)	< 0.001	$^{\Delta}$ CI: Confidence Interval		
Connective tissue disease	2.11 (2.02-2.2)	< 0.001	CONCLUSION		
ITP*	1.93 (1.76-2.12)	< 0.001			
Bone marrow transplant	1.83 (1.6-2.1)	< 0.001	• Unlike in the HIV infected p	• Unlike in the HIV infected patients, PCP in the non-	
IBD [†]	1.5 (1.38-1.63)	< 0.001	HIV infected patients is very uncommon but related		
Non-metastatic solid tumor	1.37 (1.3-1.44)	< 0.001	higher mortality, longer hospital stay and increased		
Alcohol abuse	0.91 (0.88-0.94)	< 0.001	hospital charge.		
Congestive heart failure	0.87 (0.85-0.9)	< 0.001	• There are usually risk factors that can predict the		
Chronic lung disease	0.72 (0.7-0.73)	< 0.001	occurrence of PCP. Identification of these risk factor		
Diabetes without complication	0.9 (0.88-0.93)	< 0.001	may help with the early diagnosis of PCP, especially		
Diabetes with complication	1.04 (0.99-1.09)	0.167	the non-HIV infected patients.		
Liver disease	0.72 (0.7-0.74)	< 0.001	• A risk-adjusted model for non-HIV infected patients		
Renal failure	0.84 (0.81-0.86)	< 0.001	can evaluate the probability of	can evaluate the probability of PCP. Given the high	
Smoking	0.71 (0.69-0.72)	< 0.001	negative predictive value, thi	negative predictive value, this model can help to avoi	
IBD: Inflammatory bowel disease: *	TTP: Immune thrombocytopenic pur	pura	unnecessary further workup	unnecessary further workup for PCP.	

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