

Sign	Point(s)
Temperature, °C	0
36.5-38.4	1
38.5-39.0	2
≤36 or ≥39	2
Blood leukocytes, cells/μL	0
4000-11 000	1
<4000 or >11 000	2
>500 Band forms	2
Oxygenation, PaO ₂ /FiO ₂	0
>240 or ARDS	0
≤240 or no evidence of ARDS	2
Pulmonary radiography	0
No infiltrate	0
Diffuse (or patchy) infiltrates	1
Localized infiltrate	2
Tracheal secretions	0
Score†	0
<14	1
≥14	2
Purulent sputum	2
Culture of tracheal aspirate	0
Pathogenic bacteria cultured minimal or no growth	0
Pathogenic bacteria cultured moderate or more growth	1
Moderate or greater growth of pathogenic bacteria consistent with that seen on original Gram stain	2

Abbreviation: ARDS, acute respiratory distress syndrome.
 *Total score of >6 points suggests ventilator-associated pneumonia.
 †Score calculated by quantifying amount of tracheal secretions on a subjective 0-4 scale multiple times per day, then summing all of a patient's scores for the day.

pulmonary infection score

CDC defn

VAP diagnosis

pulmonary secretions

clinical features

Box. Centers for Disease Control and Prevention (CDC) National Healthcare Safety Network Definition for Ventilator-Associated Pneumonia

Radiology signs

Two or more serial chest radiographs with at least 1 of the following:
 New or progressive and persistent infiltrate
 Consolidation
 Cavitation

Clinical signs

At least 1 of the following:
 Fever (temperature >38°C [100.4°F] with no other recognized cause)
 Leukopenia (<4000 white blood cells/μL) or leukocytosis (≥12 000 white blood cells/μL)
 For adults 70 years or older, altered mental status with no other recognized cause

Plus at least 2 of the following:
 New onset of purulent sputum, or change in character of sputum, or increased respiratory secretions, or increased suctioning requirements
 New-onset or worsening cough, or dyspnea, or tachypnea
 Rales or bronchial breath sounds
 Worsening gas exchange (eg, O₂ desaturations [eg, PaO₂/FiO₂ ≤240], increased oxygen requirements, or increased ventilation demand)

Microbiological criteria (optional)

At least 1 of the following:
 Positive growth in blood culture not related to another source of infection
 Positive growth in culture of pleural fluid
 Positive quantitative culture from bronchoalveolar lavage (≥10⁴ colony-forming units/mL) or protected specimen brushing (≥10³ colony-forming units/mL)
 Five percent or more of cells with intracellular bacteria on direct microscopic examination of Gram-stained bronchoalveolar lavage fluid
 Histopathological evidence of pneumonia

*In patients without underlying pulmonary or cardiac disease (eg, respiratory distress syndrome, bronchopulmonary dysplasia, pulmonary edema, or chronic obstructive pulmonary disease), 1 definitive chest radiograph is acceptable.

Finding and Source	Gold Standard	Sensitivity, %	Specificity, %	LR (95% CI)	
				Positive	Negative
High caluany (>400 000 cats/mL) in BAL fluid					
Nonindependent					
Balthazar et al, ⁴¹ 2001	Histology and culture	90	94	15 (2.3-103)	0.11 (0.03-0.40)
>50% neutrophils in BAL fluid					
Independent					
Kirland et al, ⁴² 1997	Histology alone	100	53	2.0 (1.4-3.0)	0.09 (0.01-1.4)
Nonindependent					
Marquette et al, ⁴³ 1995	Histology alone	95	38	1.5 (0.37-5.9)	0.10 (0.2-5)
Balthazar et al, ⁴¹ 2001	Histology and culture	95	94	16 (2.4-103)	0.05 (0.01-0.36)
Any neutrophils with intracellular bacteria in BAL fluid					
Independent					
Kirland et al, ⁴² 1997	Histology alone	33	60	0.93 (0.30-2.3)	1.1 (0.64-1.8)
Papazian et al, ⁴⁴ 1997	Histology alone	54	53	1.2 (0.55-2.4)	0.87 (0.41-1.8)
Summary				1.0 (0.59-1.9)	1.0 (0.64-1.6)
Nonindependent					
Marquette et al, ⁴³ 1995	Histology alone	37	100	6.8 (0.43-106)	0.66 (0.45-0.96)
Positive Gram stain					
Blind bronchial aspirate					
Independent					
Papazian et al, ⁴⁴ 1997	Histology and culture	56	74	2.1 (0.81-5.5)	0.60 (0.28-1.3)
Mini-BAL fluid					
Independent					
Papazian et al, ⁴⁴ 1997	Histology and culture	56	89	5.3 (1.3-22)	0.50 (0.24-1.0)
BAL fluid					
Independent					
Papazian et al, ⁴⁴ 1997	Histology and culture	44	100	18 (1.1-302)	0.56 (0.32-0.99)
Nonindependent					
Marquette et al, ⁴³ 1995	Histology alone	47	88	3.8 (0.57-25)	0.60 (0.37-0.99)
Balthazar et al, ⁴¹ 2001	Histology and culture	85	94	14 (2.1-98)	0.16 (0.06-0.45)
Culture					
Blind bronchial aspirate (>10⁴ CFU/mL)					
Independent					
Papazian et al, ⁴⁴ 1995	Histology and culture	56	95	11 (1.6-78.5)	0.47 (0.28-0.79)
Fabregas et al, ⁴⁵ 1999	Histology and culture	69	92	8.3 (1.2-55.2)	0.34 (0.15-0.77)
Summary				9.6 (2.4-38)	0.42 (0.27-0.67)
Nonindependent					
Marquette et al, ⁴³ 1995	Histology alone	61	75	2.4 (0.70-8.6)	0.52 (0.26-1.0)
BAL fluid (>10⁴ CFU/mL)					
Independent					
Torres et al, ⁴¹ 1994	Histology alone	53	42	0.86 (0.44-1.7)	1.2 (0.53-2.7)
Papazian et al, ⁴⁴ 1995	Histology and culture	53	95	10 (1.4-71.4)	0.53 (0.33-0.84)
Kirland et al, ⁴² 1997	Histology alone	11	80	0.56 (0.09-3.0)	1.1 (0.63-1.5)
Fabregas et al, ⁴⁵ 1999	Histology and culture	77	58	1.8 (0.89-3.8)	0.40 (0.13-1.2)
Summary				1.4 (0.76-2.5)	0.78 (0.51-1.2)
Nonindependent					
Marquette et al, ⁴³ 1995	Histology alone	53	100	9.5 (0.62-144)	0.50 (0.31-0.82)

Abbreviations: BAL, bronchoalveolar lavage fluid; CFU, colony-forming units; CI, confidence interval; LR, likelihood ratio.
 †Bronchoalveolar lavage fluid was obtained using fiberoptic-guided bronchoscopy, with saline lavage performed by pulmonologists or thoracic surgeons. Blind bronchial aspirates were obtained by blind insertion of a suction catheter through the endotracheal tube into a midairway bronchus, without lavage performed by nurses, respiratory therapists, or general clinicians. Mini-BAL fluid was obtained by blind insertion of a suction catheter through the endotracheal tube into a mainstem bronchus, with saline lavage performed by trained respiratory therapists or generalists.

Finding and Source	Gold Standard	Sensitivity, %	Specificity, %	LR (95% CI)	
				Positive	Negative
Fever					
Independent					
Chastre et al, ³⁸ 1984	Histology alone	67	65	1.9 (0.84-4.3)	0.51 (0.16-1.7)
Torres et al, ⁴¹ 1994	Histology alone	56	58	1.3 (0.61-2.9)	0.76 (0.38-1.5)
Fabregas et al, ⁴⁵ 1999	Histology and culture	46	42	0.79 (0.37-1.7)	1.3 (0.56-3.0)
Summary				1.2 (0.76-1.9)	0.86 (0.54-1.4)
Nonindependent					
Petersen et al, ¹⁰ 1999	Histology alone	45	33	0.68 (0.38-1.2)	1.6 (0.73-3.7)
Balthazar et al, ⁴¹ 2001	Histology and culture	50	76	2.1 (0.81-5.6)	0.65 (0.39-1.1)
Abnormal WBC count					
Independent					
Chastre et al, ³⁸ 1984	Histology alone	50	45	0.91 (0.37-2.2)	1.1 (0.44-2.8)
Fabregas et al, ⁴⁵ 1999	Histology and culture	77	58	1.8 (0.89-3.8)	0.40 (0.13-1.2)
Summary				1.3 (0.76-2.4)	0.74 (0.34-1.6)
Nonindependent					
Petersen et al, ¹⁰ 1999	Histology alone	86	7	0.93 (0.75-1.1)	2.0 (0.23-17.8)
Balthazar et al, ⁴¹ 2001	Histology and culture	60	76	2.6 (1.0-6.5)	0.52 (0.20-0.95)
Sputum purulence, macroscopic					
Independent					
Torres et al, ⁴¹ 1994	Histology alone	83	33	1.3 (0.80-2.0)	0.50 (0.14-1.8)
Fabregas et al, ⁴⁵ 1999	Histology and culture	69	42	1.2 (0.65-2.2)	0.74 (0.26-2.1)
Summary				1.3 (0.88-1.8)	0.63 (0.28-1.4)
Nonindependent					
Marquette et al, ⁴³ 1995	Histology alone	70	67	2.4 (0.91-6.1)	0.32 (0.12-0.85)
Petersen et al, ¹⁰ 1999	Histology alone	50	60	1.3 (0.59-2.6)	0.83 (0.46-1.5)
Creptitation on auscultation					
Nonindependent					
Petersen et al, ¹⁰ 1999	Histology alone	73	40	1.2 (0.75-2.0)	0.68 (0.27-1.7)
Hypoxemia					
Nonindependent					
Petersen et al, ¹⁰ 1999	Histology alone	64	40	1.1 (0.63-1.8)	0.91 (0.40-2.1)
New infiltrate on radiograph					
Independent					
Chastre et al, ³⁸ 1984	Histology alone	100	75	3.5 (1.7-7.5)	0.10 (0.01-1.4)
Torres et al, ⁴¹ 1994	Histology alone	78	42	1.3 (0.78-2.3)	0.53 (0.18-1.6)
Fabregas et al, ⁴⁵ 1999	Histology and culture	92	33	1.4 (0.88-2.2)	0.24 (0.03-1.8)
Summary				1.7 (1.1-2.5)	0.35 (0.14-0.87)
Nonindependent					
Fabregas et al, ⁴⁵ 1996	Histology alone	87	50	1.7 (0.43-7.0)	0.26 (0.05-1.5)
Petersen et al, ¹⁰ 1999	Histology alone	91	33	1.4 (0.93-2.0)	0.27 (0.06-1.2)

Abbreviations: CI, confidence interval; LR, likelihood ratio; WBC, white blood cell.