14

Pulmonary Disease

■ PNEUMONIA AND COUGH

Diagnosis of *Pneumocystis* Pneumonia in Outpatients

Clinical question

Which ambulatory patients with risk factors for human immunodeficiency virus (HIV) disease and respiratory symptoms have *Pneumocystis carinii* pneumonia (PCP)?

Population and setting

Consecutive patients with HIV risk factors and respiratory symptoms presenting to an urgent care center in San Francisco were included. Most (88%) were male; 76% were gay or bisexual; 20% were intravenous drug users; and 8% had a sexual partner in a risk group.

Study size

Although 279 patients were studied, only 125 were used in the logistic regression owing to missing data.

Pretest probability

Altogether, 24.8% of patients had *Pneumocystis carinii* pneumonia.

Type of validation

Grade IV: The training group was used as the validation group.

Comments

Given the absence of prospective validation, this rule is appropriate to identify patients at high risk but should not be used to rule out PCP.

Reference

Katz MH, Baron RB, Grady D. Risk stratification of ambulatory patients suspected of Pneumocystis pneumonia. Arch Intern Med 1991;151:105–110.

M. H. Ebell, *Evidence-Based Diagnosis*

CLINICAL PREDICTION RULE

1. Determine whether the patient has diffuse perihilar infiltrates and the number of the following abnormal findings.

   Mouth lesions
   Presence of a lactate dehydrogenase (LDH) level > 220 U/L
   Erythrocyte sedimentation rate (ESR) of 50 mm/hr or more

2. Identify the patient's risk group based on these characteristics.

Risk group	Characteristics	No. with PCP/ no. in group	LR for PCP
High	Diffuse perihilar infiltrates	21/25 (84%)	15.9
High–intermediate	No diffuse perihilar infiltrates and two or three abnormal findings	7/15 (47%)	2.7
Low–intermediate	No diffuse perihilar infiltrates and one abnormal finding	3/35 (9%)	0.3
Low	No diffuse perihilar infiltrates and no abnormal findings	0/50	0.1

LR = likelihood ratio.

Likelihood of Pneumonia in Patients with Cough

Clinical question

Which outpatients with acute cough have pneumonia on radiography?

Population and setting

All nonpregnant adults seeking medical care for the first time for coughs of less than 1 month duration at an Army Medical Center emergency department were included. Patients were excluded if they had a heart rate > 160 beats per minute, temperature > 104°F, systolic blood pressure < 90 mm Hg, or if they arrived by ambulance. Only 25% declined to participate. The mean age was 40 years; 51% were female.

Study size

A total of 483 patients were studied, plus another 1305 to calculate the specificity.

Pretest probability

Of these patients, 2.6% had pneumonia on radiography and another 2.6% had "a possible infiltrate and equivocal pneumonia."

Type of validation

Grade III: The validation group was a separate sample from the same population, although data for both training and validation groups were gathered at the same time. A jackknife validation method was used, increasing the accuracy of this approach to validation.

Comments

The major limitation of this study is that there was no clear set of criteria for interpreting the radiographs. Otherwise, it is a useful rule and is well validated.

Reference

Diehr P, Wood RW, Bushyhead J, et al. Prediction of pneumonia in outpatients with acute cough: a statistical approach. J Chronic Dis 1984;37:215–225.

CLINICAL PREDICTION RULE

1. Add up the number of points for your patient.

Finding	Points
Rhinorrhea	−2
Sore throat	−1
Night sweats	1
Myalgia	1
Sputum all day	1
Respiratory rate > 25	2
Temperature ≥ 100°F	2
Total:	

2. Based on the number of points, find the percent with pneumonia.

Score	No. with score	With pneumonia
−3	140	0%
−2	556	0.7%
−1	512	1.6%
0	323	2.2%
1	136	8.8%
2	58	10.3%
3	16	25.0%
≥4	11	29.4%

Pneumonia Prognosis Index

Clinical question

What is the prognosis for patients with community-acquired pneumonia?

Population and setting

The original study by Fine et al. included adults with symptoms and radiographic evidence of pneumonia; they were excluded if it was a readmission or they were HIV-positive. The second validation in nursing home patients by Mylotte and colleagues included 100 patients admitted from a nursing home to the hospital and 58 patients managed in the nursing home without hospital admission. The validation by Flanders et al. used 1024 randomly selected patients in 22 community hospitals.

Study size

Fine et al. developed the rule from an administrative data set with 14,199 patients and validated it in a second group of 2287 community-based and nursing home patients. Mylotte et al. validated it in 158 nursing home patients.

Pretest probability

Risk of death in the original study by Fine et al. was 5.2%; and in Mylotte et al.'s nursing home study it was 22.1%.

Type of validation

Grade I: The validation group was from a distinct population. The rule was developed in one group of patients and validated in another.

Comments

The original study by Fine et al. included a broad spectrum of community and nursing patients. A second independent validation of the rule was in a population of patients who were admitted from a nursing home or treated in a nursing home. A subsequent prospective validation in a community setting is also reported and shows that the rule discriminates well.

References

Fine MJ, Auble TE, Yealy DM, et al. A prediction rule to identify low-risk patients with community-acquired pneumonia. N Engl J Med 1997;336:243–250.

Flanders WD, Tucker G, Krishnadasan A, et al. Validation of the Pneumonia Severity Index: importance of study-specific recalibration. J Gen Intern Med 1999;14:333–340.

Mylotte JM, Naughton B, Saludades C, Maszarovics Z. Validation and application of the Pneumonia Prognosis Index to nursing home residents with pneumonia. J Am Geriatr Soc 1998;46:1538–1544.

CLINICAL PREDICTION RULE

1. Count up the number of points for your patient.

Risk factor	Points
Enter the age in years at right	
If female, subtract 10 points	−10
Nursing home resident	10
Co-morbidities	
Neoplasm	30
Liver disease	20
Heart failure	10
Stroke	10
Renal	10
Physical examination findings	
Altered mental status	20
Respiratory rate ≥ 30/min	20
Systolic BP < 90 mmHg	20
Temp < 35°C or ≥40°C	15
Pulse ≥ 125/min	10
Laboratory and radiographic findings	
Arterial pH < 7.35	30
BUN ≥ 30 mg/dl	20
Sodium < 130 mmol/L	20
Glucose ≥ 250 mg/dl	10
Hct < 30%	10
PO_2 < 50 mmHg	10
Pleural effusion	10
Total:	

2. Determine your patient's risk class.

Characteristic	Risk class
Under age 50 and no co-morbidities, abnormal physical examination findings, or laboratory or radiographic findings from the list above	I
Not class I (above) but:	
<70 points	II
71–90 Points	III
91–130 Points	IV
>130 Points	V

3. The risk of death and length of stay (where data are available) are shown below.

	Original validation cohort (community-based and nursing home) of Fine et al.			
Risk class	No. of inpatients	Inpatient mortality	Length of stay (days)	Outpatient mortality
I	772	0.1%	5	0.5%
II	477	0.9%	6	0.4%
III	326	1.2%	7	0.0%
IV	486	9.0%	9	12.5%
V	226	27.1%	11	12.5%

Note: The numbers are too small to be meaningful for risk class I and II in nursing home patients. Patients were not randomized to inpatient or outpatient treatment in

Fine et al.'s study, so one can assume that selection bias for managing healthier patients in the outpatient setting occurred.

Fine et al. recommended that patients in risk class I or II be considered for outpatient therapy and those in risk class IV and V definitely be hospitalized. Of course, the final decision on the type of therapy requires consideration of all relevant patient factors.

4. Results from two prospective validations.

	Community hospitals Flanders et al.)		Nursing home (Mylotte et al.)	
Risk class	No.	Mortality	No.	Mortality
I	14	0%	—	—
II	123	0%	—	—
III	585	1.8%	21	4.8%
IV	290	13.1%	50	12.0%
V	12	0%	85	32.9%

Prognosis in Community-Acquired Pneumonia (Geriatric)

Clinical question

What is the prognosis for community-acquired pneumonia in the elderly?

Population and setting

Patients over age 65 with an initial working diagnosis of pneumonia assigned by their admitting physician and a chest radiograph during the first 48 hours that was consistent with pneumonia were included. The following patients were excluded: those with HIV disease, previous organ transplant, receiving chemotherapy within the past 2 months, transfer from another hospital, readmission within 10 days from a prior acute care hospitalization, or discharge or death on the day of admission. Variables used to develop the rule were recorded within 24 hours of admission. This project was done as part of the Pneumonia Module of the Medicare Quality Indicator System.

Study size

The training group had 1000 patients and consisted of a random sample of patients from four states (Massachusetts, Maryland, New Hampshire, West Virginia). The validation group had 1356 patients and was a random sample of similar patients from each state in the United States. The validation group had more males (51% vs. 45%), fewer white patients (88% vs. 91%), and more patients from a skilled nursing facility (30% vs. 24%) than the training group.

Pretest probability

In the validation group, 12% of patients died, 33% went to a skilled nursing facility, 61% went home, and the rest went elsewhere.

Type of validation

Grade III: The rule was developed using one group of patients and then was validated in another group of similar patients.

Comments

This rule was developed and validated using a retrospective chart audit. Because prospective data collection can sometimes give different results, it should be prospectively validated before being applied.

Reference

Conte HA, Chen Y-T, Mehal W, et al. A prognostic rule for elderly patients admitted with community-acquired pneumonia. Am J Med 1999;106:20–28.

CLINICAL PREDICTION RULE

1. Determine your patient's risk score.

Predictor	Points
Age ≥ 85 years	1
Presence of co-morbid condition[a]	2
Impaired motor response[b]	1
Abnormal vital signs (temp > 36.1°C, SBP < 90 mm Hg or heart rate > 110 beats/min)	2
Serum creatinine level ≥ 1.5 mg/dl	1
Total:	

SBP = systolic blood pressure

[a]Co-morbid conditions include acute or chronic leukemia, Hodgkin's or non-Hodgkin's lymphoma, multiple myeloma, any cancer with local or distant metastases, hepatic failure, cirrhosis, chemotherapy or radiotherapy within the last year (but not 2 months before admission), or a collagen vascular disease.

[b]Impaired motor response is defined as failure to exhibit a motor response to verbal stimuli (localization of painful stimuli alone, flexion withdrawal, decorticate/decerebrate posturing, or no response).

2. Determine the risk of in-hospital mortality.

Risk score	In-hospital mortality
0	4%
1–2	11%
3–4	23%
>4	41%

Evaluation of Chronic Cough

Clinical question

What are the most likely diagnoses among patients presenting with chronic cough?

Population and setting

In the Mello et al. study, consecutive immune-competent outpatients referred for evaluation of chronic cough to a pulmonology clinic were included. The cough was of at least 3 weeks' duration. The mean age was 53 years (range 15–83 years); 73% were female. In the Marchesani et al. study, patients were included if they had been referred for evaluation of cough of at least 4 weeks' duration, no obvious cause was found, and it did not respond to initial treatment by their physician.

Study size

A total of 88 patients were studied by Mello et al.

Pretest probability

This parameter is not applicable.

Type of validation

Mello et al.: Grade IV: The training group was used as the validation group.
Marchesani et al.: Grade I: The test set was from a distinct population. The rule was developed in one group of patients and validated in another.

Comments

This simple rule is informative rather than predictive, as it helps guide the evaluation of patients with chronic cough but does not help make a specific diagnosis. The systematic evaluation in both studies included chest and sinus radiography, spirometry with methacholine challenge, skin testing, and occasionally esophagogastroduodenectomy or pH monitoring.

References

Marchesani F, Cecarini L, Pela R, Sanguinetti CM. Causes of chronic persistent cough in adult patients: the results of a systematic management protocol. Monaldi Arch Chest Dis 1998;53:510–514.

Mello CJ, Irwin RS, Curley FJ. Predictive values of the character, timing, and complications of chronic cough in diagnosis its cause. Arch Intern Med 1996;156:997–1003.

CLINICAL PREDICTION RULE

Unexplained chronic cough is generally caused by gastroesophageal reflux disease (GERD), postnasal drip syndrome (PND), or asthma.

Mello study
Among patients with the following three characteristics, 99.4% had either GERD, PND, or asthma as the cause of their chronic cough.

Nonsmoker
Not receiving an angiotensin-converting enzyme (ACE) inhibitor drug
Normal or nearly normal and stable chest radiograph

Marchesani study
Among patients with cough for at least 4 weeks, no obvious cause, and lack of response to "conventional therapy prescribed by general practitioners":

56% had PND, usually caused by sinusitis
14% had asthma
5% had GERD
6% had PND and GERD
1% had asthma and GERD
18% had chronic bronchitis

Likelihood of Pulmonary Infiltrates in Patients with Fever or Respiratory Symptoms

Clinical question

Which patients presenting with fever or respiratory symptoms have pulmonary infiltrates seen by chest radiography?

Population and setting

Consecutive patients more than 15 years old presenting with fever or respiratory symptoms to an emergency department who underwent radiography were included. The mean age was 43 years; 46% were male.

Study size

The training group had 1134 patients and the validation group 302.

Pretest probability

In the validation group, 25.8% had pneumonia, as did 12.4% in the training group.

Type of validation

Grade I: The validation group was from a distinct population. The rule was developed in one group of patients and validated in another.

Comments

This is an excellent clinical rule—easy to use and well validated. It was validated again in a study by Emerman et al., where it was found to be somewhat less sensitive than the judgment of experienced physicians (71% vs. 86%) but more specific (67% vs. 58%) and overall more accurate (68% vs. 60%).

References

Emerman CL, Dawson N, Speroff T, et al. Comparison of physician judgment and decision aids for ordering chest radiographs for pneumonia in outpatients. Ann Emerg Med 1991;20:1215–1219.

Heckerling PS, Tape TG, Wigton RS, et al. Clinical prediction rule for pulmonary infiltrates. Ann Intern Med 1990;113:664–670.

CLINICAL PREDICTION RULE

1. Count the number of points for your patient (range 0–5).

Finding	Points
Temperature > 38.7°C	1
Pulse > 100 beats/minute	1
Rales	1
Decreased breath sounds	1
Absence of asthma	1
Total:	

2. Add up the number of points and use the table below to interpret the results. Note that two sets of pretest probability are given, 28% and 19%.

	% With infiltrate	
Points	(28% Pretest probability)	(19% Pretest probability)
0	3%	1.6%
1	9%	5%
2	24%	14%
3	51%	35%
4	77%	63%
5	91%	85%

Prognosis with Pneumonia and Acute Respiratory Failure

Clinical question

Which critically ill patients admitted to the intensive care unit (ICU) with acute bacterial pneumonia and acute respiratory failure will survive?

Population and setting

All adult patients admitted to the ICU of a French hospital with acute bacterial pneumonia (confirmed by clinical and radiologic data) and acute respiratory failure (not defined) were included. The mean age was 52 years (range 18–86 years); 80% were male; most (70%) were on artificial ventilation.

Study size

There were 96 patients in the validation group.

Pretest probability

In-hospital mortality rate was 57%.

Type of validation

Grade I: The validation group was from a distinct population. The rule was developed in one group of patients and validated in another.

Comments

Generalizability may be an issue, as French hospitals use different criteria for admission to their small ICUs than American hospitals. This rule uses the Simplified Acute Physiology Score, developed originally to assist in ICU prognostication.

Reference

Durocher A, Saulnier F, Beuscart, et al. A comparison of three severity score indexes in an evaluation of serious bacterial pneumonia. Intensive Care Med 1988;14:39–43.

CLINICAL PREDICTION RULE

1. Calculate the Simplified Acute Physiology Score for your patient:

	Points									
Variable	4	3	2	1	0	1	2	3	4	Total
Age (years)					≤40	41–55	56–65	66–75	>75	
Heart rate	≥180	140–179	110–139		70–109		55–69	40–54	<40	
SBP (mm Hg)	≥190		150–189		80–149		55–79		<55	
Body temp. (°C)	≥41	39.0–40.9		38.5–38.9	36.0–37.4	34.0–35.9	32.0–33.9	30.0–31.9	<30.0	
Spontaneous respiration rate or ventilation on CPAP	≥50	35–49		25–34	12–24	10–11	6–9	Yes	<6	
Urinary output (L/24hr)			≥5.0	3.5–4.99	0.7–3.49		0.50–0.69	0.20–0.49	<0.2	
Blood urea (mmol/L)	≥55.0	36.0–54.9	29.0–35.9	7.5–26.9	3.5–7.4	3.5				
Hematocrit (%)	≥60.0		50.0–59.9	46.0–49.9	30.0–45.9		20.0–29.9		<20.0	
WBC count ($10^3/mm^3$)	≥40.0		20.0–39.9	15.0–19.9	3.0–14.9		1.0–2.9		<1.0	
Serum glucose (mmol/L)	≥44.5	27.8–44.4		14.0–27.7	3.9–13.9		2.8–3.8	1.6–2.7	<1.6	
Serum potassium (mEq/L)	≥7.0	6.0–6.9		5.5–5.9	3.5–5.4	3.0–3.4	2.5–2.9		<2.5	
Serum sodium (mEq/L)	≥180	161–179	156–160	151–155	130–150		120–129	110–119	<110	
Serum HCO_3 (mEq/L)		≥40.0		30.0–39.9	20.0–29.9	10.0–19.9		5.0–9.9	<5.0	
GCS					13–15	10–12	7–9	4–6	3	
								Total:		

SBP = systolic blood pressure; CPAP = continuous positive airway pressure; WBC = white blood cells; GCS = Glasgow Coma Scale.

2. The following mortality rates were found.

Score	Mortality rate
≥17	83.3% (n = 30)
13–16	55.3% (n = 38)
≤12	32.1% (n = 28)

Risk of Nosocomial Pneumonia in the Intensive Care Unit

Clinical question

Which patients in the intensive care unit (ICU) for at least 72 hours will develop nosocomial pneumonia?

Population and setting

Consecutive adult patients admitted to the ICU of a university hospital and staying at least 72 hours were included. The mean age was 57 years; 57% were male.

Study size

Altogether, 203 patients were studied.

Pretest probability

Of these patients, 12.8% developed a nosocomial pneumonia.

Type of validation

Grade IV: The training group was used as the validation group.

Comments

The terms "rapidly fatal" and "ultimately fatal" disease are not clearly defined. Furthermore, the rule has not been prospectively validated. This rule should therefore be used with caution.

Reference

Joshi N, Localio AR, Hamory BH. A predictive risk index for nosocomial pneumonia in the intensive care unit. Am J Med 1992;93:135–142.

CLINICAL PREDICTION RULE

1. Identify which risk factors your patient has and multiply these scores.

Risk factor	Score if risk factor is present
Age > 60 years	2.0
Ultimately fatal disease	3.0
Rapidly fatal disease	4.0
Upper abdominal/thoracic surgery	4.0
Intubation	2.0
Altered consciousness	1.5
Nasogastric tube	6.5
H_2-blocker therapy	2.0
Recent bronchoscopy	3.0
Product:	

2. The probability of pneumonia can be found in the table below.

Product	Probability of pneumonia
0	0%
3	1%
5	1%
8	2%
10	3%
12	3%
15	4%
20	5%
30	8%
40	11%
50	14%
60	18%
70	21%
80	25%
100	33%
120	43%
140	54%
160	67%
180	82%
200	100%

3. To calculate an exact estimate, multiply the "Product" from the table by 0.0025. This is the odds of pneumonia.

4. A patient is considered high risk if the odds are >0.11 (sensitivity 85%, specificity 66% for nosocomial pneumonia).

5. If desired, convert the odds to probability.

$$\text{Probability of nosocomial pneumonia} = \frac{\text{odds}}{(1 - \text{odds})}$$

This rule had an area under the ROC curve of 0.86, with a 27% positive predictive value and a 97% negative predictive value. That means that 97% of patients considered at low risk did not develop a nosocomial pneumonia, and 27% of the high risk patients did develop pneumonia.

Example: a patient with rapidly fatal disease, upper abdominal/thoracic surgery, and nasogastric tube has a product of $4 \times 4 \times 6.5 = 104$. Multiply this product by 0.0025 to get the odds of 0.26. Convert them to a probability: $0.26/(1 - 0.26) = 35\%$.

■ ACUTE RESPIRATORY DISTRESS SYNDROME

Prognosis for Acute Respiratory Distress Syndrome

Clinical question

Which patients with acute respiratory distress syndrome (ARDS) will have a complicated course (early death or prolonged intubation)?

Population and setting

Adult patients at a tertiary medical center with ARDS diagnosed by standard criteria were included. Patients had to have all of the following: (1) acute respiratory failure requiring intubation; (2) rapid development of diffuse bilateral infiltrates; (3) recent exposure to an agent known to precipitate acute long injury; (4) pulmonary occlusion pressure < 18 mm Hg or absence of echocardiographic evidence of cardiogenic pulmonary edema; (5) total respiratory system compliance ≤ 50 ml/cm H_2O; and (6) severe hypoxemia.

Study size

Altogether, 126 patients were used to develop the rule and 50 patients to validate it prospectively.

Pretest probability

At day four, 72% were defined as having a complicated course. At day seven, 75% had a complicated course. Mortality for patients with a complicated course was 64% at seven days.

Type of validation

Grade II: The test set was a separate sample from the same population, with data for the test set gathered prospectively.

Comments

The radiograph viewers and researchers gathering clinical data did not participate in the care of the study patients. This is a well validated rule. The major limitation is the small size of the validation set, but this is understandable given the relative rarity of the condition.

Reference

Heffner JE, Brown LK, Barbieri CA, et al. Prospective validation of an acute respiratory distress syndrome predictive score. Am J Respir Crit Care Med 1995;152: 1518–1526.

CLINICAL PREDICTION RULE

1. Calculate the ARDS risk score.

Variable	Points
Chest radiograph compared with day 0	
Normalization of the radiograph	0
Clinically important radiographic improvement	1
Relative stability of radiographic infiltrates	2
Clinically important radiographic worsening	4
PaO_2/PAO_2 (ratio of arterial/alveolar oxygen tension)	
≥0.8	0
≥0.06 and <0.8	1
≥0.4 and <0.6	2
≥0.2 and <0.4	3
<0.2	4
Applied positive end-expiratory pressure (PEEP) (cm H_2O)	
0–5	0
6–8	1
9–11	2
12–14	3
≥15	4
Total:	

2. Interpret the risk score. A patient with a score ≥ 2.5 is considered at "high risk." Outcomes for 50 low risk and high risk patients in the validation study are shown below.

	Day 4 (50 total patients)		Day 7 (44 total patients left)	
Risk group	Complicated course (n = 36)	Death (n = 24)	Complicated course (n = 33)	Death (n = 21)
Low	16%	10%	23%	16%
High	56%	38%	52%	32%

■ OBSTRUCTIVE SLEEP APNEA

Diagnosis of Sleep Apnea Syndrome

Clinical question

Which patients referred for sleep studies actually have sleep apnea syndrome?

Population studied

Consecutive patients referred for a sleep study to a sleep clinic, which is the sole referral center for the province of Alberta, were included. A total of 83 of 263 (31.5%) did not participate owing to patient refusal ($n = 34$), a severe cardiac, neurologic, or pulmonary condition ($n = 23$), previous sleep apnea diagnosis ($n = 7$), use of tranquilizers or antidepressants ($n = 8$), or other reasons ($n = 11$). The mean age was 46 years; 75% were male.

Study size

Altogether, 180 patients were studied.

Pretest probability

Of these patients, 45% had sleep apnea syndrome.

Type of validation

Grade IV: The training group was used as the validation group.

Comments

The strength of this study is the complete capture of a referral population, making it more generalizable. The weakness is the lack of prospective validation and some potential for misinterpretation of predictor variables ("habitual snorer" and "history of gasping from partner"). It should be used with caution.

Reference

Flemons WW, Whitelow WA, Brant R, Remmers JE. Likelihood ratios for a sleep apnea clinical prediction rule. Am J Respir Crit Care Med 1994;150:1279–1285.

CLINICAL PREDICTION RULE

1. Count how many of the following historical features your patient has.

Habitual snoring
Partner reports nocturnal choking/gasping

2. Find the row with your patient's neck circumference, then go to the column that reflects the hypertensive status and the number of historical features present.

	Score, by number of historical features					
	Not hypertensive			Hypertensive		
Neck circumference (cm)	None	One	Both	None	One	Both
28	0	0	1	0	1	2
30	0	0	1	1	2	4
32	0	1	2	1	3	5
34	1	2	3	2	4	8
36	1	3	5	4	6	11
38	2	4	7	5	9	16
40	3	6	10	8	13	22
42	5	8	14	11	18	30
44	7	12	20	15	25	42
46	10	16	28	21	35	58
48	14	23	38	29	48	80
50	19	32	53	40	66	110

3. Finally, interpret the number of points from the above table as follows (an apnea-hypopnea index > 10 is diagnostic of sleep apnea syndrome).

Sleep apnea clinical score	Likelihood ratio	Probability of sleep apnea syndrome (based on pretest probability of 45%)
≤5	0.25 (0.15–0.42)[a]	17%
5.01–10.0	1.09 (0.62–1.92)	47%
10.01–15	2.03 (0.94–4.38)	62%
>15	5.17 (2.54–10.51)	81%

[a]Numbers in parentheses are the 95% confidence interval.

■ ASTHMA AND CHRONIC OBSTRUCTIVE PULMONARY DISEASE

Asthma in Adults

Clinical question

Which adult patients with asthma are likely to require hospitalization during the next year?

Population and setting

Patients age 18–50 years with moderate to severe asthma, on daily therapy for asthma, and with at least three visits to their physician during the previous year were included. The mean age was 38.4 years; 67% were female; and 36% were members of an ethnic minority (Hispanic, Asian, African American, or Native American).

Study size

A total of 323 patients were studied.

Pretest probability

Of these patients, 5.8% were hospitalized during the 1-year follow-up.

Type of validation

Grade IV: The training group was used as the validation group.

Comments

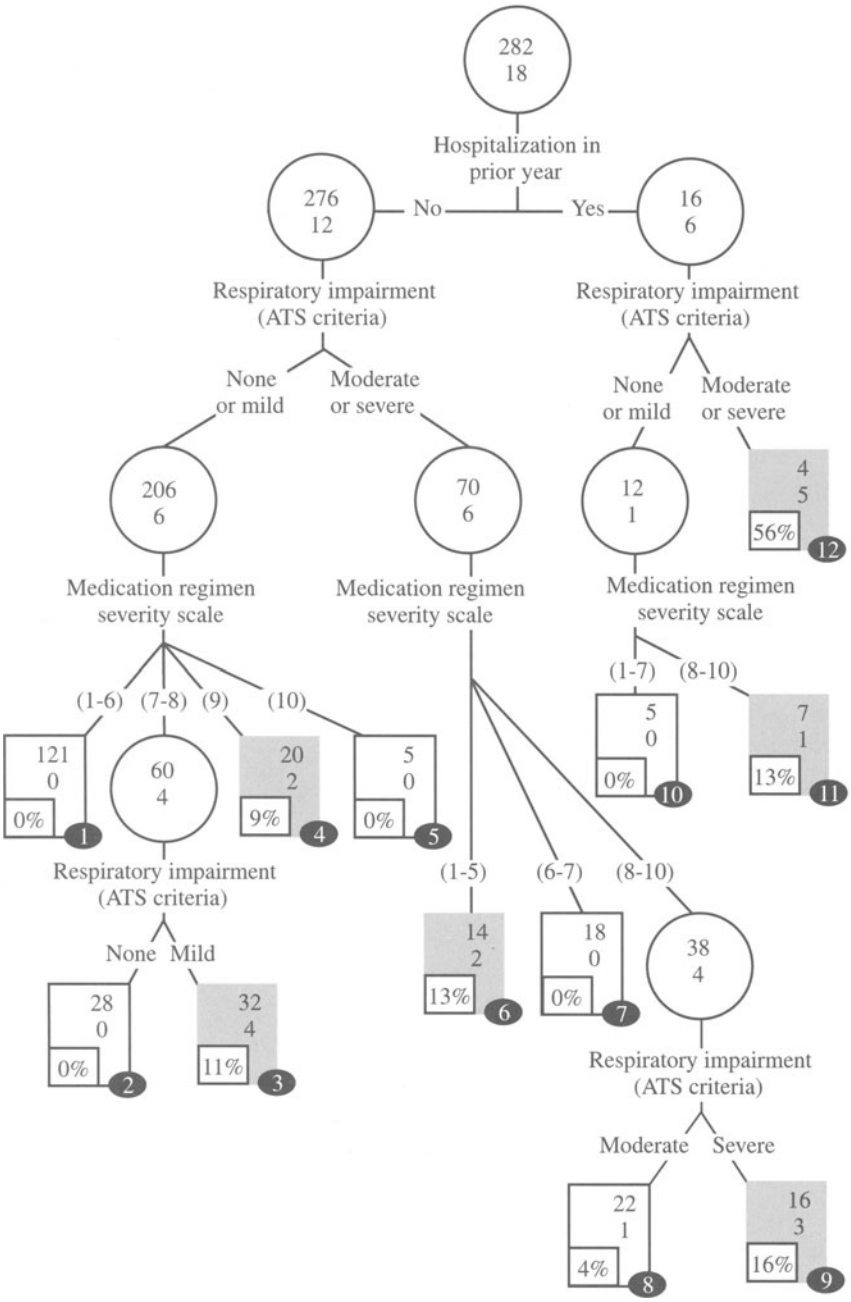
This rule can help identify outpatients at higher than average risk for asthma complications and who might benefit from more intensive educational efforts. It should be used with caution, as it has not been prospectively validated.

Reference

Dominic L, German D, Lulla S, Thomas RG, Wilson SR. Prospective study of hospitalization for asthma. Am J Respir Crit Care 1995;151:647–655.

CLINICAL PREDICTION RULE

Upper number is total children in group; lower number is children requiring hospitalization.



CYSTIC FIBROSIS

Survival with Cystic Fibrosis

Clinical question

What is the prognosis for patients with cystic fibrosis?

Population and setting

Patients referred to a British hospital with a diagnosis of cystic fibrosis were included. The rule was developed in patients seen between 1979 and 1987 and followed until 1989 or death. It was validated in a prospective cohort recruited between 1988 and 1993 and followed for 1 year or until their death. The age range in the validation group was 13–45 years; half were male.

Study size

The training group had 403 patients and the validation group 100.

Pretest probability

Of the study patients, 50.4% died during the study period.

Type of validation

Grade II: The validation group was a separate sample from the same population, with data for the validation group gathered prospectively.

Comments

Because this score was developed using data from the 1970s and 1980s and validated during the 1990s, it may underestimate survival today. For example, quinolones were not widely used until the 1990s. Note that the outcomes are approximations only and were extrapolated from a survival graph in the original article.

Reference

Hayllar K, Williams SG, Wise AE, et al. A prognostic model for the prediction of survival in cystic fibrosis. Thorax 1997;52:313–317.

CLINICAL PREDICTION RULE

1. Calculate the predictive index.

Variable	Points
Hepatomegaly present	0.99
Height (meters)	+ height × 1.54
% FEV1 of predicted	− % × 0.59
% FVC of predicted	− % × 0.038
WBC (10^9 cells/L)	+ WBC × 0.09
Total:	

FEV1 = forced expiratory volume in 1 second; FVC = forced vital capacity; WBC = white blood cells.

Example: a patient with a height of 1.54 meters, hepatomegaly, FVC = 50% predicted, FEV1 = 35% predicted, and WBC = 20 × 10^9 cells/L has the following predictive index (PI).

$$PI = (-3.410 \times 1.54) + (0.99 \times 1) - (0.038 \times 50)$$
$$- (0.059 \times 35) + (0.09 \times 20) = -6.4$$

2. Find the probability of survival at 1 year for the patient's score (these data were extrapolated from Figure 2 in the original article).

Score	Approximate probability of 1-year survival
≤ −10	>95%
−10 to −7.5	80–95%
−7.4 to −6	40–80%
> −6	<40%