

JOURNAL READING

Present: PGY 張為淵

Supervisor: VS 吳柏衡

102.11.27

Material

When Do Clinical Decision Rules Improve Patient Care?

Steven M. Green, MD

0196-0644/\$-see front matter
Copyright © 2013 by the American College of Emergency Physicians.
<http://dx.doi.org/10.1016/j.annemergmed.2013.02.006>

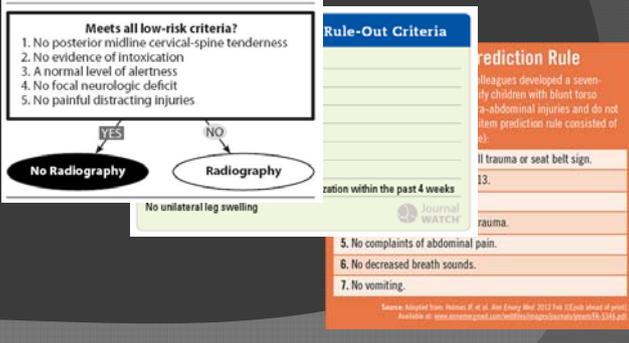
CLINICAL DECISION RULES/ORIGINAL RESEARCH

Comparison of the Unstructured Clinician Gestalt, the Wells Score, and the Revised Geneva Score to Estimate Pretest Probability for Suspected Pulmonary Embolism

Andrea Penaloza, MD; Franck Verschuren, MD, PhD; Guy Meyer, MD; Sybille Quentin-Georget, MD; Caroline Soulie, MD; Frédéric Thys, MD, PhD; Pierre-Marie Roy, MD, PhD

Clinical Decision Rules

Figure 11. National Emergency X-Radiography Utilization Study (NEXUS) Criteria



Psychologically appealing

- Create **order** out of disorder
- Transform such murky complexity into **structured and tangible** tools
- Statistically derived from **10,000 or more** patients



So

- Certainly a scientific decision instrument must be superior to the frailty and variability of clinician judgment

Is this true????

- Before we adopt these tools, there are some questions we should ask first.

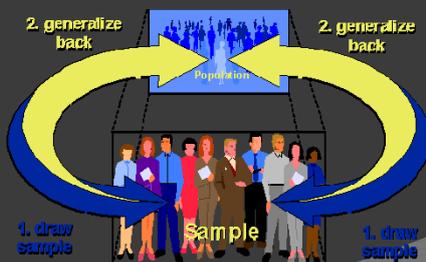
DOES THE RULE ADDRESS A CLINICALLY RELEVANT QUESTION?

- Decision rules that address trivial or uncommon questions are likely to be more trouble than they are worth.
- Optimal patient-oriented rather than surrogate outcomes.

HAS THE RULE BEEN RIGOROUSLY DERIVED?

- The best decision rules demonstrate rigorous standards for derivation, which have been detailed elsewhere

HAS THE RULE BEEN EXTERNALLY VALIDATED?



DOES THE RULE REQUIRE 1-WAY RATHER THAN 2-WAY APPLICATION?

Table A Seven-Item Prediction Rule

James F. Holmes, MD, MPH, and colleagues developed a seven-item checklist that aimed to identify children with blunt torso trauma who are at low risk for intra-abdominal injuries and do not benefit from CT scans. The seven-item prediction rule consisted of (in descending order of importance):

1. No evidence of abdominal wall trauma or seat belt sign.
2. Glasgow Coma Scale score >13.
3. No abdominal tenderness.
4. No evidence of thoracic wall trauma.
5. No complaints of abdominal pain.
6. No decreased breath sounds.
7. No vomiting.

Source: Adapted from Holmes JF, et al. *Ann Emerg Med*. 2012 Feb 11 [pub ahead of print]. Available at: [www.annemergmed.com/article/S1555-2616\(12\)00058-5](http://www.annemergmed.com/article/S1555-2616(12)00058-5). DOI: 10.1016/j.annemergmed.2012.01.011

DOES THE RULE IMPROVE ON PREEXISTING CLINICAL PRACTICE?

A. CT ordering by gestalt.

	Intra-abdominal Injury	
	Yes	No
CT ordered in ED	194	5,389
No CT ordered in ED	12	6,652
	203	11,841

ED, Emergency department.
 True sensitivity=192/203=94% (95% confidence interval [CI] 90% to 97%).
 Sensitivity excluding 11 too unstable for CT and taken directly to laparotomy=192/192=99% (95% CI 97% to 100%).
 Specificity=6,652/11,841=56% (95% CI 55% to 57%).
 Likelihood ratio of positive gestalt=2.3 (95% CI 2.2 to 2.3).
 Likelihood ratio of negative gestalt=0.09 (95% CI 0.06 to 0.07).
 Percentage of all children receiving CT=34%.

B. CT ordering by 1-way application of the clinical decision rule.

	Intra-abdominal Injury With Intervention	
	Yes	No
Both positive gestalt and positive rule	195	3,930
Negative gestalt or negative rule	7	7,911
	203	11,841

Sensitivity=195/203=97% (95% confidence interval [CI] 93% to 99%).
 Specificity=7,911/11,841=67% (95% CI 66% to 68%).
 Likelihood ratio positive=2.9 (95% CI 2.8 to 3.0).
 Likelihood ratio negative=0.05 (95% CI 0.02 to 0.11).
 Percentage of all children receiving CT=34%.

C. CT ordering by 2-way application of the clinical decision rule.

	Intra-abdominal Injury with Intervention	
	Yes	No
Rule positive	197	6,813
Rule negative	6	5,028
	203	11,841

Sensitivity=197/203=97% (95% confidence interval [CI] 94% to 99%).
 Specificity=5,028/11,841=42% (95% CI 40% to 43%).
 Likelihood ratio of positive rule=1.7 (95% CI 1.6 to 1.7).
 Likelihood ratio of negative rule=0.07 (95% CI 0.03 to 0.15).
 Percentage of all children receiving CT=48%.

DOES THE RULE APPLY TO YOUR PRACTICE SETTING AND YOUR TARGET POPULATION?

Table A Seven-Item Prediction Rule

James F. Holmes, MD, MPH, and colleagues developed a seven-item checklist that aimed to identify children with blunt torso trauma who are at low risk for intra-abdominal injuries and do not benefit from CT scans. The seven-item prediction rule consisted of (in descending order of importance):

1. No evidence of abdominal wall trauma or seat belt sign.
2. Glasgow Coma Scale score >13.
3. No abdominal tenderness.
4. No evidence of thoracic wall trauma.
5. No complaints of abdominal pain.
6. No decreased breath sounds.
7. No vomiting.

Source: Adapted from Holmes JF, et al. *Ann Emerg Med*. 2012 Feb 11 [pub ahead of print]. Available at: [www.annemergmed.com/article/S1555-2616\(12\)00058-5](http://www.annemergmed.com/article/S1555-2616(12)00058-5). DOI: 10.1016/j.annemergmed.2012.01.011

Where is FAST??

IS THE RULE EASY TO REMEMBER AND APPLY?



Example

Comparison of the Unstructured Clinician Gestalt, the Wells Score, and the Revised Geneva Score to Estimate Pretest Probability for Suspected Pulmonary Embolism

Andrea Penaloza, MD; Franck Verschuren, MD, PhD; Guy Meyer, MD; Sybille Quentin-Georget, MD; Caroline Soulie, MD; Frédéric Thys, MD, PhD; Pierre-Marie Roy, MD, PhD

PE Background

- Estimated annual incidence of 70 cases per 100,000 in US
- Difficult-to-diagnose
- Clinical signs and symptoms are common and neither specific nor sensitive

3 ways to evaluate *pre-test* probability of PE

- Gestalt assessment
- Wells score
- Revised Geneva score
- Which performs better?

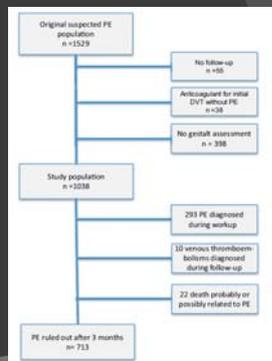
Table 1. Clinical decision rules.

Score	Points
Wells score*	
Clinical signs of DVT (edema and pain)	3.0
Alternative diagnosis less likely than PE	3.0
Pulse rate >100 beats/min	1.5
Recent surgery or immobilization (within 4 wk)	1.5
Previous PE or DVT	1.5
Hemoptysis	1.0
Cancer	1.0
Revised Geneva score*	
Age >65 y	1
Previous PE or DVT	3
Surgery under general anesthesia or fracture (lower limb) within 4 wk	2
Active malignancy	2
Unilateral lower limb pain	3
Hemoptysis	2
Pulse rate 75-94 beats/min	3
Pulse rate >95 beats/min	5
Pain on lower-limb deep vein palpation and unilateral edema	4

DVT, Deep venous thrombosis; PE, pulmonary embolism.
 *Greater than 2: low clinical probability; 2 to 6: moderate clinical probability; greater than 6: high clinical probability.
 †Zero to 3: low clinical probability; 4 to 10: moderate clinical probability; greater than or equal to 11: high clinical probability.

Materials and Methods

- 5 ED in France
- 1 ED in Belgium
- 5 weeks period for collection
- 3 months F/U after discharge



Baseline characteristic

Table 2. Baseline characteristics of the study population.*

Patient Characteristics	Excluded Population, n=491	Study Population, n=1,038
Mean age, y (95% CI)	65 (63-67)	64 (63-65)
Female sex	288 (58.7; 54.3-63.0)	644 (62.0; 59.1-65.0)
Cancer	41 (8.4; 6.1-11.1)	69 (6.6; 5.3-8.3)
Personal history	118 (24.0; 20.4-28.0)	237 (22.8; 20.4-25.5)
VTE		
Past surgery <1 mo	27 (5.5; 3.7-7.8)	39 (3.8; 2.7-5.1)
Fracture	11 (2.2; 1.2-3.9)	31 (3.0; 2.1-4.2)
Palpation pain and lower limb edema	68 (13.8; 11.0-17.1)	136 (13.1; 11.2-15.3)
Final PE	149 (30.4; 26.4-34.5)	325 (31.3; 28.5-34.2)

VTE, Venous thromboembolism.
 *Data are presented as percentage (95% CI) unless otherwise indicated.

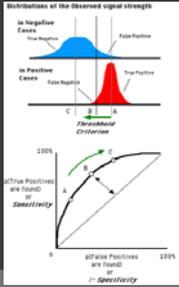
Table 3. Diagnostic method for 325 final pulmonary embolism diagnoses.

Final PE (n=325)	n
CT	173
High probability V/Q lung scan	63
Proximal DVT on leg US	37
Angiography	1
Echocardiography and high CP	5
VTE during FU	10
Death during FU possibly or probably PE related	22
Inappropriate strategy	14

CP, Clinical probability; FU, follow-up.

Comparison method

- Accuracy: ROC curve
- Discordance and disagreement : kappa test



$$K = \frac{P_o - P_e}{1 - P_e}$$

P_o : 觀測一致性(observed agreement): 前後(兩種)測量結果一致的百分比
 P_e : 期望一致性(chance agreement): 前後(兩種)測量結果預期相同的機率

Poor Slight Fair Moderate Substantial Essentially Perfect
 Kappa 0.0 0.20 0.40 0.60 0.80 1.0

Result

Penabaz et al Estimating Pretest Probability for Suspected Pulmonary Embolism

Table 4. Comparison of assessment methods: proportion of patient categorized and pulmonary embolism prevalence in each clinical probability level.

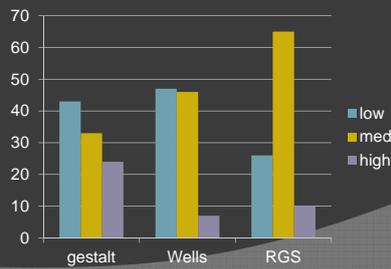
CP Assessment (n=1,038) (%; 95% CI)	Gestalt	Wells Score	RGS
Number of patients			
Low	445 (43; 40-46)	486 (47; 44-50)	270 (26; 23-29)
Moderate	342 (33; 30-36)	478 (46; 43-49)	669 (65; 62-67)
High	251 (24; 22-27)	74 (7; 6-9)	99 (10; 8-11)
Number of pulmonary embolisms			
Low	34 (7.6; 5.4-10.4)	61 (12.6; 9.8-15.4)	35 (13; 9.3-17.4)
Moderate	110 (32.2; 27.4-37.3)	221 (42.6; 41.8-50.7)	222 (33.2; 29.7-36.8)
High	181 (72.1; 66.3-77.4)	43 (58.1; 46.7-68.9)	68 (68.7; 59.1-77.2)

CP, Clinical probability; RGS, revised Geneva score.

Result : Accuracy

CP Assessment (n=1,038) (%; 95% CI)	Gestalt	Wells Score	RGS
Number of patients			
Low	445 (43; 40-46)	486 (47; 44-50)	270 (26; 23-29)
Moderate	342 (33; 30-36)	478 (46; 43-49)	669 (65; 62-67)
High	251 (24; 22-27)	74 (7; 6-9)	99 (10; 8-11)

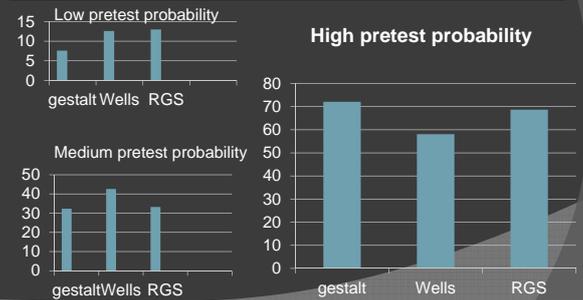
● Patient distribution



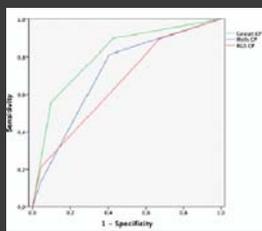
Result : Accuracy

CP Assessment (n=1,038) (%; 95% CI)	Gestalt	Wells Score	RGS
Number of pulmonary embolisms			
Low	34 (7.6; 5.4-10.4)	61 (12.6; 9.8-15.4)	35 (13; 9.3-17.4)
Moderate	110 (32.2; 27.4-37.3)	221 (42.6; 41.8-50.7)	222 (33.2; 29.7-36.8)
High	181 (72.1; 66.3-77.4)	43 (58.1; 46.7-68.9)	68 (68.7; 59.1-77.2)

CP, Clinical probability; RGS, revised Geneva score.



Result : Accuracy



The AUC was
 gestalt: 0.81 (95% CI 0.78 to 0.84),
 Wells: 0.71 (95% CI 0.68 to 0.75),
 RGS: 0.66 (95% CI 0.63 to 0.70)

Result : Agreement

Penabaz et al Estimating Pretest Probability for Suspected Pulmonary Embolism

Table 5. Agreement on the 3 clinical probability assessment methods in patients with suspected pulmonary embolism, compared 2 by 2.

PE Prevalence %; n	Probability	RGS			Total
		Low	Moderate	High	
Gestalt assessment*	Low	188 (42.8)	240 (49.8)	111 (23.2)	445 (7.6)
	Moderate	62 (24.2)	253 (51.6)	27 (55.6)	342 (33.2)
	High	20 (80.0)	170 (69.4)	61 (83.6)	251 (72.1)
	Total	270 (13.0)	663 (51.2)	99 (98.7)	1,038

PE Prevalence %; n	Probability	Gestalt Assessment			Total
		Low	Moderate	High	
Wells	Low	214 (44.8)	137 (28.0)	35 (57.1)	486 (12.6)
	Moderate	180 (35.8)	186 (40.9)	172 (73.2)	478 (42.6)
	High	11 (0)	33 (42.1)	44 (78.2)	74 (58.1)
	Total	445 (7.6)	342 (32.2)	251 (72.1)	1,038

PE Prevalence %; n	Probability	Wells			Total
		Low	Moderate	High	
RGS	Low	102 (15.2)	71 (18.2)	9 (6)	270 (13.0)
	Moderate	280 (15.4)	360 (47.2)	23 (34.8)	669 (51.2)
	High	8 (87.6)	45 (57.8)	46 (76.1)	99 (98.7)
	Total	486 (12.6)	478 (42.6)	74 (58.1)	1,038

RGS, Revised Geneva score.
 * Coefficients = 0.22 (95% CI 0.17 to 0.26).
 † Coefficients = 0.28 (95% CI 0.20 to 0.28).
 ‡ Coefficients = 0.30 (95% CI 0.21 to 0.31).



Result : Discordance

	Gestalt vs Wells	Gestalt vs RGS	Wells vs RGS
Discordance	48%	52%	45%
Major disagreement	4%	3%	1%

Discussion

- Accuracy : gestalt > Wells > RGS
- 在病人分佈和相對應PE prevalence分析看來, gestalt 更能有效分別non-high和high pre-test probability of PE
- 且三種方法幾乎沒有一致性

Reason

- Clinical decision rules are simplified models constructed from most frequent dichotomized or categorized data. Conversely, **gestalt assessment allows us to consider and integrate all clinical signs and symptoms in more detail**
- Runyon et al showed that the accuracy of gestalt assessment remains good **independently of physician's training level**

Review these 2 rules

- An overriding of clinical decision rules by a physician's implicit clinical judgment may improve clinical decision rules' performance.

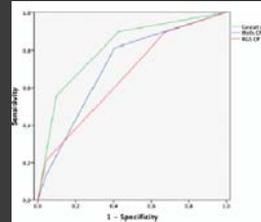


Table 1. Clinical decision rules.

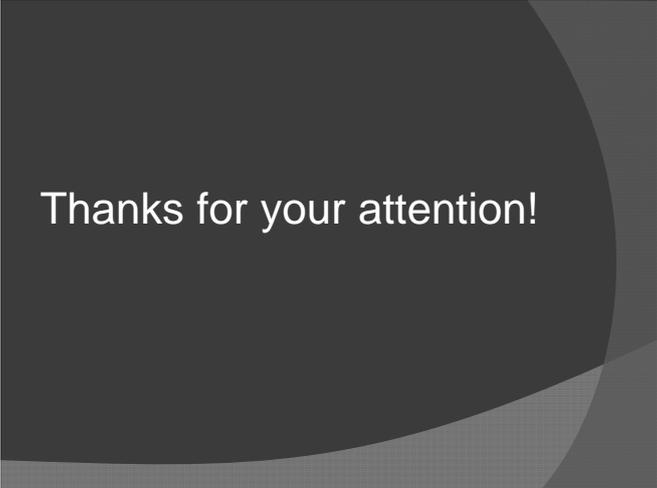
Score	Points
Wells score*	
Clinical signs of DVT (edema and pain)	3.0
Alternative diagnosis less likely than PE	3.0
Pulse rate ≥ 100 beats/min	1.5
Recent surgery or immobilization (within 4 wk)	1.5
Previous PE or DVT	1.5
Hemoptysis	1.0
Cancer	1.0
Revised Geneva score*	
Age > 65 y	1
Previous PE or DVT	3
Surgery (under general anesthesia) or fracture (lower limb) within 4 wk	2
Active malignancy	2
Unilateral lower limb pain	3
Hemoptysis	2
Pulse rate 75-94 beats/min	3
Pulse rate ≥ 95 beats/min	5
Pain on lower-limb deep vein palpation and unilateral edema	4

DVT, Deep venous thrombosis; PE, pulmonary embolism.
 *Greater than 2: low clinical probability; 2 to 6: moderate clinical probability; greater than 6: high clinical probability.
 †Zero to 3: low clinical probability; 4 to 10: moderate clinical probability; greater than or equal to 11: high clinical probability.

Conclusion

- The overall performance of gestalt appeared to be superior to that of the 2 scores, with better selection of patients with a low or high clinical probability of pulmonary embolism.
- The improved performance seems to be related to subjective assessment, which allows the physician to take into account all signs, symptoms, and risk factors of patients with suspected pulmonary embolism.





Thanks for your attention!