Usefulness of Clinical Pre-test Scores for a Correct Diagnostic Pathway in Patients with Suspected Pulmonary Embolism in Emergency Room

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Abstract: *Background*: Pulmonary Embolism (PE) is a disease characterized by not specific signs and symptoms. In Italy, there are about 65,000 cases per year; mortality is about 30% if PE is not identified and decreases to 2-8% if PE is recognized and treated. International guidelines include several strategies for diagnosing the disease with confidence. The diagnostic pathway includes a clinical approach with the Wells and Revised Geneva scores, the use of D-dimer and, eventually, a Computed Tomography (CT). The CT seems to be the ideal investigation to confirm or exclude PE but it is not free from complications. Sometimes in medical practice clinicians tend to order CT more frequently than necessary, reflecting a defensive behavior instead of an evidence based behavior. This practice exposes patients to some risks, especially for kidney.

Objective: To identify the efficiency of the use of clinical scores and diagnostic algorithms following the latest guidelines in patients with suspicion of PE. To analyze how many CTs could be avoided using the right approach and to evaluate the importance of any clinical variable. Eventually, to apply the two scores together (Wells score and Revised Geneva score).

Methods and Materials: A retrospective, single centre, cohort study was performed from January 2011 to April 2012. All patients who made a CT in the Emergency Room for suspicion of PE were collected and classified in two groups: PE - and PE +. In all patients Wells Score and Revised Geneva Score were calculated.

Results: 111 patients (64% female; mean age 72±16 years) were studied. There were no differences in anamnestic, clinical and laboratory variables between the two groups. With the classic pathway 6 patients could have been safely ruled out without performing a CT. With the Wells score one PE+ patient had a low pre-test probability; with the Revised Geneva score actually 7 PE+ patients had a low pre-test probability. These results were source of doubt about the reliability of the scores. So we tried to use the two scores together, and we achieved these results: in 7 patients PE could have been safely excluded without even using CT scan.

Conclusions: The study focuses on the clinical approach to PE. The clinical scores proposed by guidelines (Wells score and Revised Geneva score) are unreliable if used alone, out of a pathway. We propose to the application of the two score together to exclude PE safely without performing CT when not necessary.

Keywords: Pulmonary Embolism, Wells score, Revised Geneva score, CIN (contrast-medium-induced nephropaty), clinical diagnosis, Guidelines.

BACKGROUND

Pulmonary Embolism (PE) is a disease characterized by not specific and very common signs and symptoms that range from clinical silence to hemodinamic failure [1]. For this reason, the disease presents a diagnostic challenge to emergency department physicians [2].

In Italy, there are about 65,000 cases per year; mortality is about 30% if PE is not identified and decreases to 2-8% if PE is recognized and treated [3]. Hence, the importance to certainly diagnose the disease [4, 5].

In latter decades, different diagnostic algorithms have been proposed for use in patients with suspected acute PE [6]. In fact, no single noninvasive test seems to be suitable in all cases and different information need for the diagnosis.

International guidelines [7] include several strategies for diagnosing the disease with confidence. The referential diagnostic pathway includes a clinical approach with the Wells [8, 9] or the Revised Geneva [10] scores, the use of D-dimer [11-13] and, eventually, a Computed Tomography (CT) [7].

The CT seems to be the ideal investigation [9, 14-16] to confirm or exclude PE because it is not much invasive, it has a good accuracy (sensitivity 83%, specificity 96%) [14] and it is available in the Emergency Department, but it is not free from complications, especially due to the administration of contrast media [17].

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Table 1. Patients Distribution According to Clinical Probability by the Well Score, the Revised Geneva Score and Both the Scores Together

	PE +		PE -		
	Patients Number	%	Patients Number	%	"p"
Wells score					
<2	1	3	2	3	not significant
2-6	31	84	69	93	not significant
>6	5	13	3	4	not significant
Revised Geneva Score					
0-3	7	19	22	30	not significant
4-10	28	76	51	69	not significant
>11	2	5	1	1	not significant
Wells score + Revised Geneva score					
Low	0	0	1	1	not significant
Intermediate	32	87	69	93	not significant
High	5	13	4	6	not significant

Sometimes in medical practice clinicians tend to order CT more frequently than necessary, reflecting a defensive behavior instead of an evidence based behavior [18]. This practice exposes patients to some risks, especially for kidney.

OBJECTIVE

To evaluate the appropriateness of diagnostic management of suspected PE in the Emergency Room (ER). To identify the efficiency of the use of clinical scores and of the diagnostic algorithm following the latest guidelines in patients with suspicion of PE. To analyze how many CTs could be avoided using the right approach and to evaluate the importance of any clinical variable. Eventually, to apply the Wells score and the Revised Geneve score together.

METHODS AND MATERIALS

A retrospective, single centre, cohort study was performed from January 2011 to April 2012. All patients who made a CT in the ER of the Hospital "Fatebenefratelli" in Milano for suspicion of PE were collected and classified in two groups: PE - and PE +. PE diagnosis was made on the basis of CT results. A multidetector CT (MDCT) was used and it was considered diagnostic of PE when it showed a clot at least at the segmental level of the pulmonary arterial tree (according to guidelines).

In all patients, a clinical assessment of PE probability was done with the Wells Score and the Revised Geneva Score and other variables (anamnestic, clinical and laboratory data) were considered. The outcome measure was positive MDCT.

Student T-test was used for comparing the means and Chi-square test was used for comparison of proportion between the two groups. A p value of less than 0.05 was considered significant.

RESULTS AND DISCUSSION

111 patients (64% female; mean age 72±16 years) were studied. There were no differences in anamnestic, clinical and laboratory variables between the two groups, except for signs of deep vein thrombosis (DVT) and for oxygen saturation.

The PE prevalence in the study is 33,3%, comparable to that indicated in literature that is 10-35% [7]. With the Wells score one PE+ patient had a low pre-test probability and 3 PE- patients had an high pre-test probability. With the use of the Revised Geneva score 7 PE+ patients had low pre-test probability and 1 PE- patient had high pre-test probability (Table **1**). Furthermore, there is not a statistical correlation between PE and the clinical probability with the Wells score or the Revised Geneve score: this is a source of doubts about the reliability of the scores.

With the single use of these scores the most of patients had an intermediate clinical probability, likely it could be related to the cohort characteristics, in fact these patients were old (mean age 72 and the Revised Geneva score is increased by the age) and they had several different comorbidity that could increase the score even in PE absence.

Furthermore, in the Wells score there is a really subjective item: "Alternative diagnosis less likely than PE" that increases the number of patients collocated in the intermediate pre-test probability. Using the classic pathway 6 patients (5.4%) could have been safely ruled out without using CT (with the Wells or with the Revised Geneva score indifferently). This means that clinicians made a CT without real need in 5.4% of patients. (Chart **1** and Chart **2**).
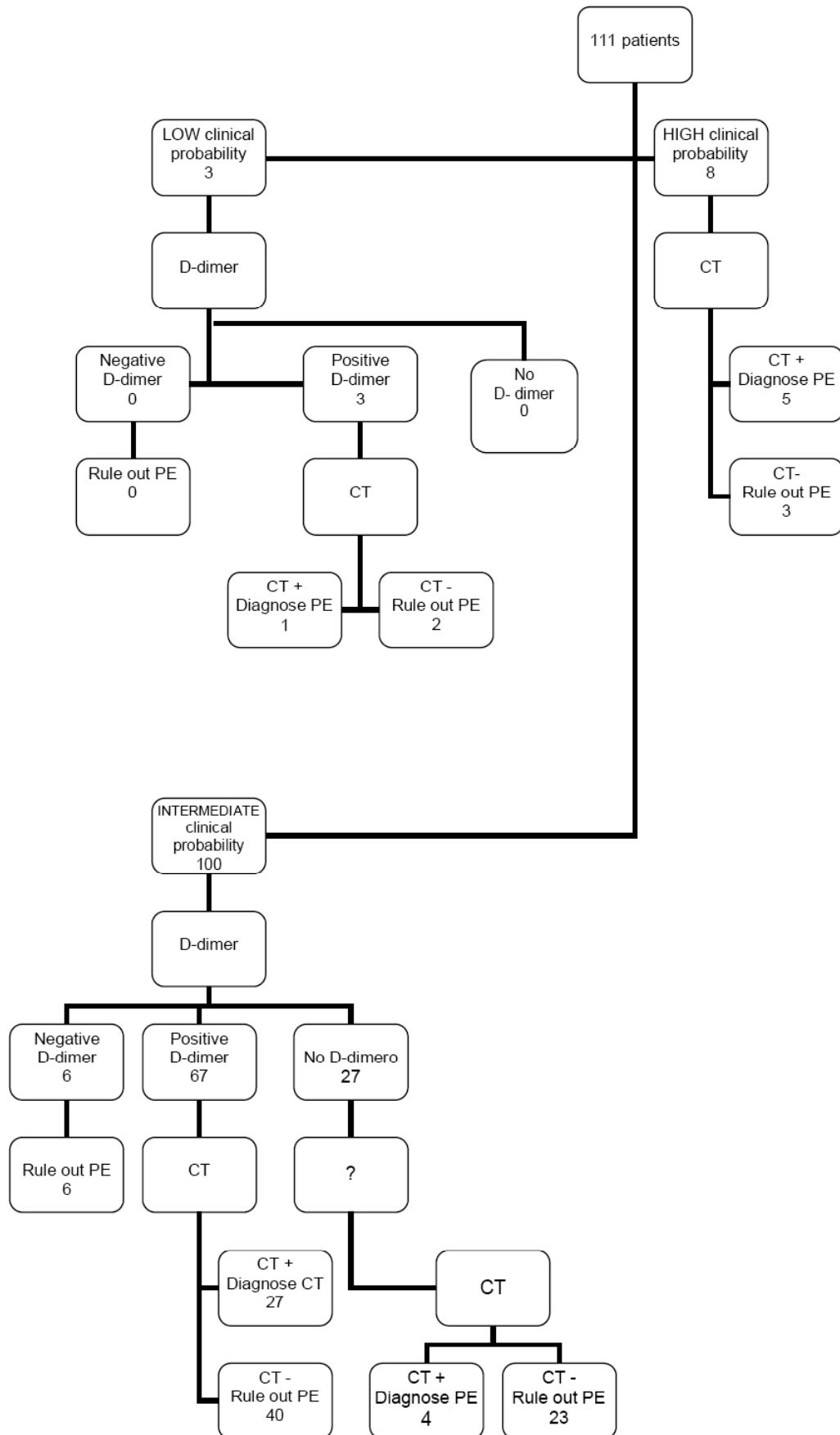
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                                                   ┌──────────────┐
                                                   │ 111 patients │
                                                   └──────────────┘
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        ┌──────────────────────────────────────────────────────────────────┐
        │                                                                   │
┌─────────────────┐                                               ┌─────────────────┐
│ LOW clinical    │                                               │ HIGH clinical   │
│ probability     │                                               │ probability     │
│ 3               │                                               │ 8               │
└─────────────────┘                                               └─────────────────┘
        │                                                                   │
┌─────────────────┐                                               ┌─────────────────┐
│ D-dimer         │                                               │ CT              │
└─────────────────┘                                               └─────────────────┘
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LOW clinical probability 3

D-dimer

- Negative D-dimer 0 → Rule out PE 0
- Positive D-dimer 3 → CT
  - CT + Diagnose PE 1
  - CT - Rule out PE 2
- No D-dimer 0

HIGH clinical probability 8

CT
- CT + Diagnose PE 5
- CT- Rule out PE 3

INTERMEDIATE clinical probability 100

D-dimer

- Negative D-dimer 6 → Rule out PE 6
- Positive D-dimer 67 → CT
  - CT + Diagnose CT 27
  - CT - Rule out PE 40
- No D-dimero 27 → ?
  - CT
    - CT + Diagnose PE 4
    - CT - Rule out PE 23

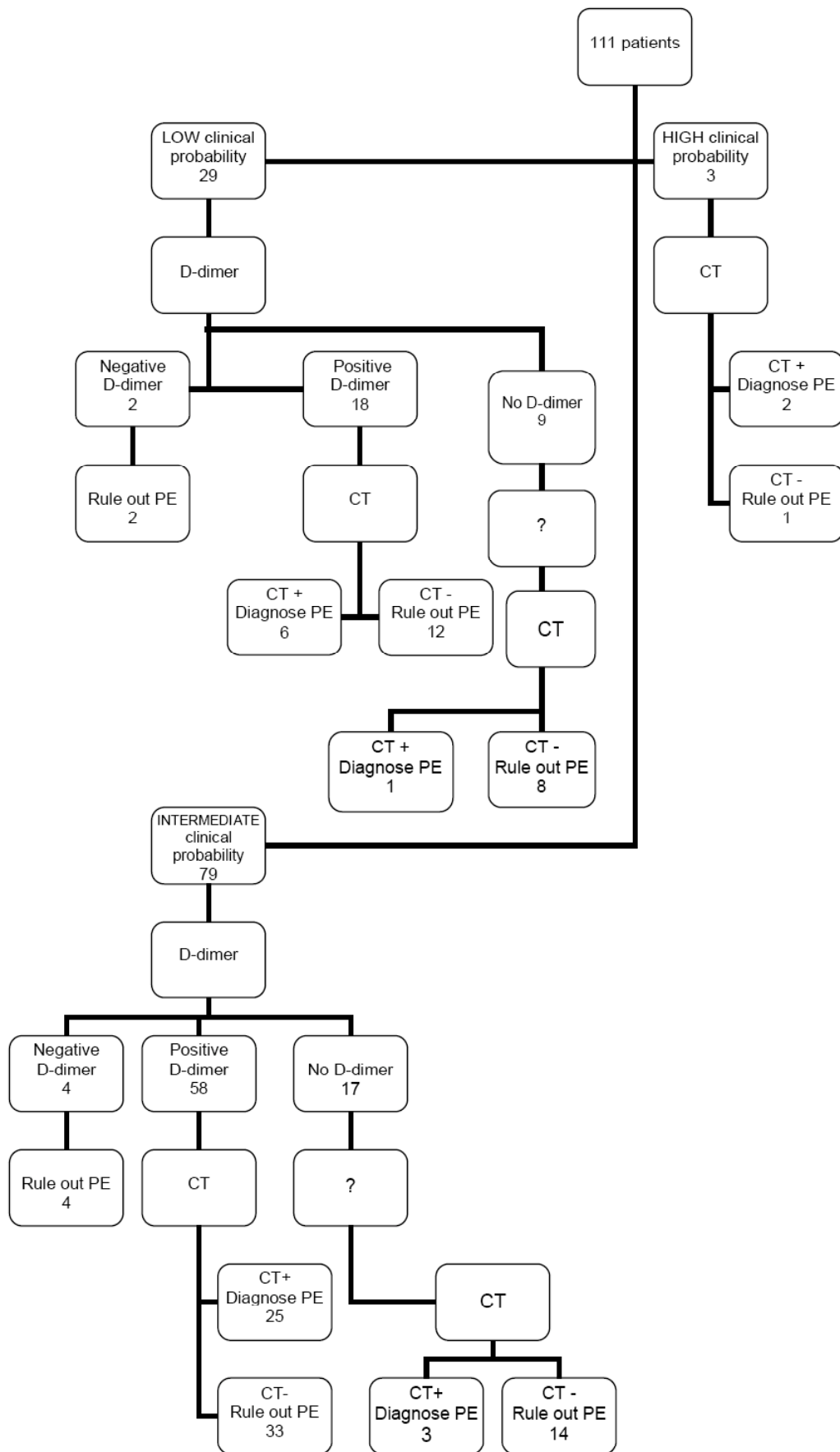**Chart 1**. Diagnostic algorithm with the Wells score.

Chart 2. Diagnostic algorithm with the Revised Geneve score.
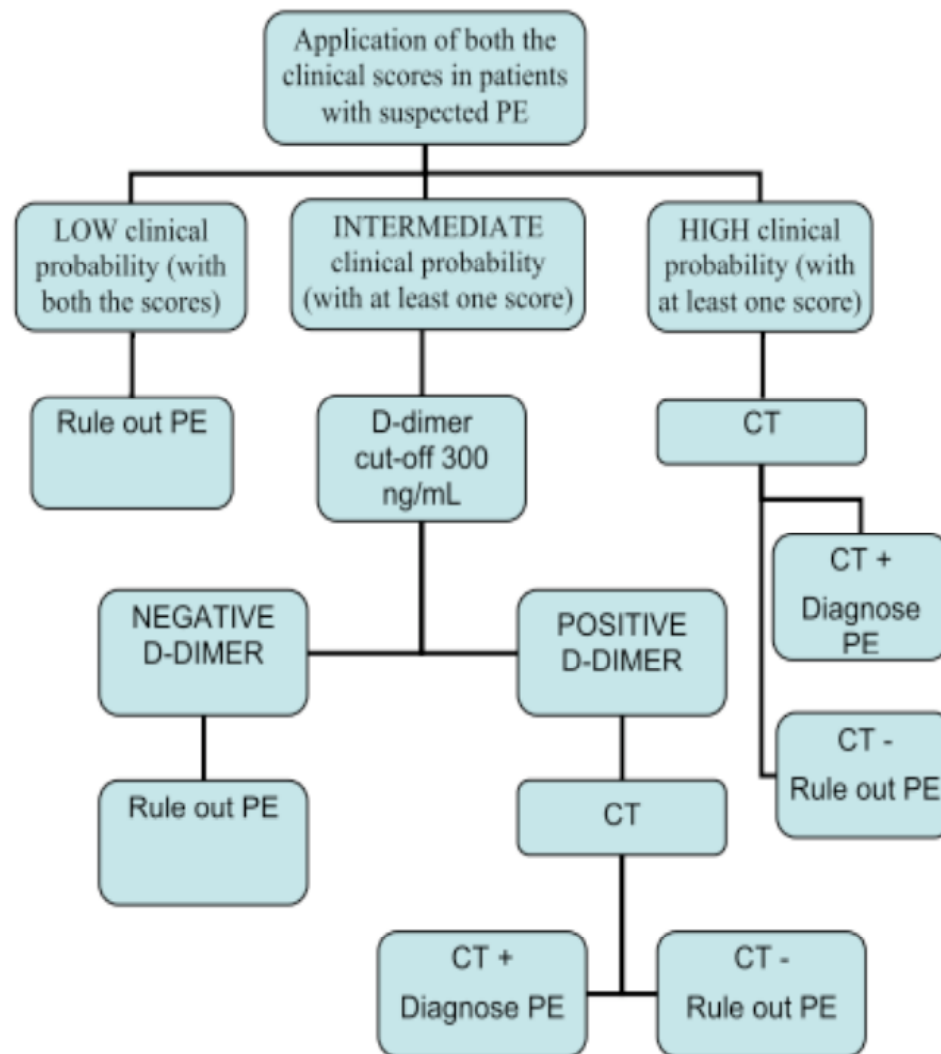
Chart 3. Use of the Wells score and the Revised Geneva score together.

Finally, the use of the Wells score and the Revised Geneve score together was tested. Applying both the score together PE could have been safely excluded in 7 patients (6.3%) without even using CT scan, one patient more than seen with the usual algorithm.

Furthermore, with this approach there are not patients PE+ with low clinical probability, only one patient has a low clinical probability and it is PE- (even if its D-dimer was high it was useless in presence of low clinical probability with both the scores) (Chart **3**). In that case, sensibility is virtually 100%.

CONCLUSIONS

The study focuses on the clinical approach to PE. The clinical scores proposed by guidelines (Wells score and Revised Geneva score) [7] are unavoidable but are not a conclusive and sole step in the diagnosis of PE. They are unreliable if used out of a pathway.

In some cases clinicians order more CTs than needed, so exposing patients to some avoidable risks. However, applying the guidelines algorithm, CT could be avoided in a small number of patients (5.4%), not statistically significative.

We propose to apply both the scores (Wells score and Revised Geneva score) together to exclude PE safely without performing CT when not necessary. This new approach demonstrated a high sensibility but needs further validation, especially on a higer sample size to become an element of daily clinical practice.

CONFLICT OF INTEREST

The authors confirm that this article content has no conflicts of interest.

ACKNOWLEDGEMENT

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