Wells' score for early prehospital screening of pulmonary embolism

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ABSTRACT

Pulmonary embolism (PE) represents a significant health problem due to non-specific clinical features and a high risk of lethal outcome. PE diagnostics can sometimes be very difficult, especially at the prehospital level. We present a patient in whom early screening for PE at the prehospital level, performed using the Wells' Score, was a life-saving event.

Case scenario: the Emergency Medical Service (EMS) received a call regarding a male, aged 27 years, who was unconscious. Prior to losing consciousness, he complained of suffocation and tachycardia. Ten days earlier he sustained an injury to the knee which was immobilized with a splint, followed by bed rest. A year ago he was examined for chest pain, hypertension and tachycardia. On examination the patient was conscious, well oriented, eupneic, afebrile, with normal skin color. On pulmonary auscultation breath sounds were normal, and oxygen saturation was 90%. Findings on cardiac examination included: regular rate and rhythm, no murmur, blood pressure (BP) 120/85mmHg on both arms. ECG revealed sinus rhythm, rate of 100 beats/min, discreet signs of right heart strain (S1Q3T3 pattern), negative T wave from V1-V4, ST depression in D2, D3, AVF. A Wells' score of 6 (most probably PE) was calculated: immobilization for 4 weeks – 1.5 points, tachycardia (pulse 120/min) – 1.5 points and alternative diagnosis less probable than PE – 3 points. The patient was suspected of PE and referred to a cardiologist.

Conclusion. Pulmonary embolism often remains undiagnosed during a patient's lifetime or is erroneously diagnosed. The significance of the scoring of each patient aimed at the recognition of pulmonary embolism at the prehospital level cannot be underestimated.

Key words: pulmonary embolism, prehospital level, Wells' Score

INTRODUCTION

Acute pulmonary embolism (PE) is a potentially life-threatening emergency situation, involving obstruction of the pulmonary artery or arteriole. The annual incidence of PE is 100-200 cases per 100,000 inhabitants, with the assumption that this number is even higher because the disease often remains undiagnosed during a person's life-time. In 25-30% of cases the signs of new or old PE are detected only on autopsy. (1) As people over 40 years of age are at a higher risk of the development of PE than young people, and as the risk may be approximately doubled with every next decade of life, it is expected that in the future an increasing number of patients will be diagnosed with PE.

Clinical features of this disease are variable, ranging from no symptoms to sudden death as the first and only presentation of PE. Up-to-date European Society of Cardiology (ESC) Guidelines (from 2014) on the diagnosis and management of acute pulmonary embolism define diagnostic criteria for the clinical confirmation of PE and criteria for the exclusion of PE.

According to its clinical manifestation, PE is classified as massive, sub-massive and non-massive. Most small pulmonary embolisms occur asymptomatically. Larger emboli cause dyspnea, pleural pain, rarely cough and hematochezia. Massive emboli lead to hypotension, circulatory collapse and heart failure.

Because most patients ultimately die within the first hours of presentation, early diagnosis is of paramount importance. At the prehospital level, except for ECG findings, the clinical probability for PE can be assessed by the application of scoring systems based on anamnestic data, clinical features and risk factors. The simplest one is the Wells' Score (table 1). (2) The sum of 0-1 points implies a low, 2-6 points a moderate and over 7 a high clinical probability of PE. Pulmonary embolism is hardly probable if the score value is 4 and lower, and probable if the score is higher than 4 points.

We are presenting a case of early PE recognized at the hospital level by using the Wells' Score.

Table 1. Wells' Score.

Wells' rule	POINTS
Symptoms and signs of DVT	3
Alternative diagnosis less probable than PE	3
Tachycardia (pulse > 100)	1.5
Surgery or immobilization within the past four weeks	1.5
Previous PE or DVT	1.5
Haemoptysis	1
Malignancy within 6 months or metastasis	1

DVT, deep venous thrombosis; PE, pulmonary embolism.

Value >4 – high probability of PE, requires immediate computed tomography (color

doppler) (depending on the findings of leg veins ultrasound, pulmonary angiogram).

Value <4 – low probability of PE, determine D-dimer (normal excludes PE, increased –necessary CT imaging).

CASE PRESENTATION

The Emergency Medical Service (EMS) was dispatched after a first line priority call was received regarding a 27-year old male who was unconscious, as stated by an eye-witness. Prior to the loss of consciousness, the patient had a feeling of suffocation and tachycardia. Seven days earlier, during training, he sustained an injury to the knee that was immobilized by a splint and followed by bed rest. A year ago he was examined for chest pain, hypertension and tachycardia. On examination the patient was conscious, well oriented, eupneic, afebrile, with normal skin color and visible mucosa. The left lower limb was immobilized with a splint, and was of a somewhat bigger circumference than the right one, with preserved peripheral pulses.

On pulmonary auscultation breath sounds were normal, and oxygen saturation was 90%. Findings on cardiac examination included: regular rate and rhythm, without murmur, normal blood pressure (BP) 120/85mmHg on both arms. ECG revealed sinus rhythm, cardiac frequency 100/min, discreet signs of right heart strain (S1Q3T3 pattern), negative T wave from V1-V4, ST depression in D2, D3, AVF (figure1).

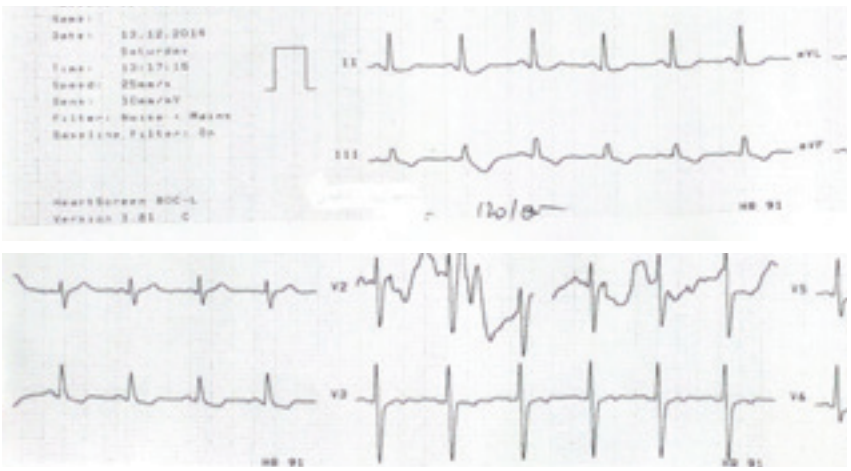

Figure 1. Prehospital ECG finding.

During neurological examination, with the slightest physical exertion, the heart beat rose to about 120/min. We excluded aortic dissection as a differential diagnosis (symmetric pulses and BP in arms, no murmur over the precordium, earlier cardiac echocardiogram (ECHO), chest X-ray normal). Acute myocardial infarction (AMI) was also excluded (no angina, earlier ECG findings showed Rr' interval and negative T wave in D3). Neurological examination excluded neurological causes of loss of consciousness.

A Wells' Score of 6 (most probably PE) was calculated based on the following findings: immobilization for 4 weeks – 1.5 points, tachycardia (pulse 120/min) – 1.5 points, alternative diagnosis less probable than PE – 3 points. The patient, diagnosed with dyspnoea, palpitations, loss of consciousness, sprained left knee and suspected PE, was transported to a tertiary healthcare facility where by further diagnostic examinations (ECG, ECHO, multi slice computed tomography (MSCT), laboratory) PE was confirmed (figure 1). The MSCT angiography of the pulmonary arteries revealed an occlusive thrombus from the pulmonary artery bifurcation distally (more to the right) with propagation into lobar and segmental branches and increasing D-dimer (3321, reference range 0-300 ng/ml). Brain natriuretic peptide (BNP) (291, upper limit value 100 pg/mL), NT-proBNP (1630, upper limit value 300 pg/mL) Laboratory findings: increased troponin level (0.90, reference range 0.35) indicated a newly developed right heart volume overload. Fibrinolytic therapy was commenced.

DISCUSSION

Pulmonary embolism (PE) is the main cause of mortality, morbidity and hospitalization in Europe. It is a significant health problem due to non-specific clinical features and a high risk of lethal outcome. Knowledge of risk factors increases the possibility of diagnostics and prevention of PE, however it can also develop in patients without any recognizable predisposing factors. In our case a convincing predisposing factor for PE was the knee injury and associated bed rest, after which PE developed, which in accordance with reports in the literature, occurs 4-7 days after injury. (3) In rare cases, PE can develop immediately after trauma. (4) Except for trauma, immobilization and long-lasting bed confinement, as in our patient, other predisposing risk factors for the development of PE are surgical interventions, pregnancy and the postpartum period, usage of hormonal therapy or oral contraceptives, cancer, spinal cord injury, myocardial infarction and previous venous thromboembolism. These provoking factors most frequently develop during the last 5 weeks to 3 months before making the diagnosis. The worrying data is that PE can occur even in the absence of any known risk factor.

Imminent clinical assessment of the presence or absence of hemodynamic compromise allows the classification of patients into a high risk group or the group which is not at high risk. This classification of patients with a suspected PE helps in the choice of optimal diagnostic and initial therapeutic options. The evaluation of "clinical probability" is based on predisposing factors, as well as signs and symptoms detected in the patient. Although individual in each patient, according to Pollack et al., in EMS the initial symptomatology of PE involves dyspnea, chest pain, presyncope or syncope, tussis and/or haemoptysis. (5) The data on syncope as the predecessor of PE is reported not only in our manuscript but also in papers of other authors. (6) Other symptoms of PE are suffocation, tachycardia, rapid feel-

ing of fatigue, unconsciousness, although it can be also asymptomatic. In some papers, in 89% of cases the suspected PE is diagnosed on the basis of clinical symptoms only. (1) Physical findings in PE are tachypnea (≥20/min.), tachycardia (>100/min) which was 120/min in our patient, with deep venous thrombosis of the lower extremities, cyanosis, body fever >38.5˚C, hypotension, swollen neck veins, systolic murmur over the tricuspid orifice, increased second sound over the pulmonary artery, S4 gallop.

A diagnosis of PE is difficult to make so that it can often remain unrecognized due to nonspecific clinical features. In research conducted by Cohen et al., conducted in six countries, of total 317,000 deaths caused by PE, 34% were a sudden fatal PE, 59% were due to undiagnosed PE during a life-time, and only 7% of patients had PE diagnosed before death. (7) According to the guidelines, (1) a differential diagnosis of AMI, aneurism or aortic dissection were prehospitally excluded in our patient.

Under hospital conditions, the diagnosis of PE is confirmed by pulmonary X-rays, gas analyses, ECG, echocardiography, coagulation status, enzyme and biochemical status, while main detection methods include computerized pulmonary angiography and perfusion scintigraphy of the lungs, gas analyses and D-dimer plasma test. Under prehospital conditions it was only possible to define oxygen saturation in the blood and perform an ECG. Hypoxemia and ECG findings indicated PE. Over the last several decades, due to complex diagnostics of PE, the need appeared for making an objective evaluation of the patient's condition. The significance of PE early screening has been considered in several large studies, including PIOPED (Prospective Investigation on Pulmonary Embolism Diagnosis). (8)

Score systems were developed which became especially applicable in EMS due to the need for defining exact parameters for triage of PE patients. The standardized Wells' Score (2) was the simplest and most applicable in the Emergency Department. In the reported case, a Wells' Score of 6 was obtained (high probability of PE). This supported the decision regarding the application of oxygentherapy and urgent transport to a cardiac care facility. Beside the Wells' Score, a revised Geneva Score is also in usage. A comparison of these two tests concluded that the Wells' Score was of higher sensitivity in the early screening of PE. (9)

CONCLUSION

Pulmonary embolism is not frequently diagnosed during a patient's life-time. The application of the Wells' Score can be helpful in the early prehospital screening of PE.

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