

THROMBOELASTOGRAPHY AND PRO-CALCITONINA IN THE DIAGNOSIS OF POSTOPERATIVE SEPSIS IN A PATIENT WITH NEGATIVE BACTERIOLOGICAL VALUES: CLINICAL CASE

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ABSTRACT

Introduction: Thromboelastography (TEG) is a diagnostic method able to evaluate the viscoelastic capacity of coagulation from the formation to lysis. TEG makes it possible to distinguish if bleeding is related to a lack of surgical hemostasis, a platelet dysfunction, protease coagulation anomalies, or an excessive and precocious fibrinolysis.

Materials and methods: The authors describe the use of thromboelastography associated with pro-calcitonina in a patient with post-operative sepsis who exhibited indications of high sensitivity in the septic state.

Discussion: This clinical case demonstrates that coagulation is strongly influenced by the septic state, and thromboelastography was found to be an excellent indication of the septic state.

Key words: Thromboelastography, pro-calcitonina, postoperative sepsis, disseminated intravascular coagulation, hyperfibrinolysis.

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Introduction

Thromboelastography (TEG) is a diagnostic method able to evaluate the viscoelastic capacity of coagulation from the formation to lysis⁽¹⁾. TEG makes it possible to distinguish if bleeding is related to a lack of surgical hemostasis, a platelet dysfunction, protease coagulation anomalies, or an excessive and precocious fibrinolysis⁽²⁾. It is a more accurate and controllable procedure to examine the circulatory system and is also useful to uncover a pro-inflammatory stage in critical patients.

Materials and methods

In September 2014 a male patient, V.G., age 69, came to the emergency room of our hospital with signs of septic shock. He appeared to be in a stupor, with body temperature 38.2°C, responsive to verbal and painful stimulation (GCS 10). Chest

examination revealed a vesicular murmur that was harsh in all pulmonary fields during breathing. The SpO₂ was 95% in ambient air. Hemodynamics were stable (AP 110/60mmHg, cardiac rate 100 beats/minute). Diuresis was present and valid. Hemo-chemical exams were performed, as well as ECG and total-body CT. The latter revealed the presence of marked left hydro-nephrosis. Hence the patient was taken to the operating room for nephrostomy. After surgery the patient appeared alert, cooperative, well-oriented in time and space, afebrile, with the following values: SpO₂ 99%, with Ventmask FiO₂ 40%, NIBP 65/40mmHg, CF 80bpm. Pressure alterations persisted so a continuous infusion of dobutamine was administered at a dose of 10mcg/Kg/min.

The first day 09/20/2014 the EGA demonstrated good respiratory exchange; microbiology exams (bronchial and culture) were negative, while the continuous infusion was continued at the same dose

for the hemodynamic deficit. During the second day in the ICU (09/21/2014) the patient's clinical condition worsened: tachycardia, hypotension, tachypnea, abdominal pain on superficial and deep palpation. Routine hemodynamic exams were performed, in addition to pro-calcitonina (PCT), which revealed the patient's septic state (Table 1).

DATE	9/20/2014	9/21/2014		9/22/2014		9/23/2014		9/24/2014		9/25/2014
TIME	8:00	8:00	11:00	8:00	18:00	8:00	8:00	17:00	8:00	
WBC	18,405	23,150	16,330	21,450	17,930	15,390	6,600	7,520	5,240	
PCT	82	138	115	51.02	48	33.18	12.2	8.56	8.56	

Table 1: Changes in WBC and PCT during hospitalization.

After requesting a surgical consultation, the patient underwent CT without contrast of the chest and upper/lower abdomen, which revealed signs of inflammation in the peri-urethral adipose tissue, modest aqueous fluid in the Douglas cavity, consolidation of pulmonary parenchyma in the vessels, especially on the right. After studying the patient's CT and clinical condition the surgical team decided on an urgent exploratory operation and eventual left nephrectomy. Following significant anemia during the operation the patient was transfused with two bags of concentrated RBC and plasma.

After surgery the patient returned to ICU and underwent sedation and analgesia with Diprivan and Remifentanyl, oral-tracheal intubation, and connected to a mechanical respirator in the A/C ventilation mode. Hemodynamic support was also provided by a continuous infusion of noradrenalin at a dose of 0.08mcg/Kg/min. On the third day 09/22/2014 the patient was afebrile and still undergoing A/C ventilation. Given the hourly diuresis of 0.9ml/Kg/h the administration of furosemide was suspended, and the noradrenalin was gradually reduced. A chest x-ray was performed in bed and showed an area of basal right hypo-diaphania; thickening of the bronchial walls and the peri-bronchial-vascular interstice, obliterated right costofrenic breast, partially obliterated contralateral breast. Cultures of several microbiological samples the same day (blood, urine, bronchial aspirate, swabs (nasal, rectal, pharyngeal), urinary and vessel catheter, were negative for bacteria or fungus. On the other hand, a high level of PCT persisted (Table 1).

In the afternoon we observed a significant decline in platelets so a TEG was performed (Fig. 1) on a native serum sample and with heparins, whose graph showed a phase length of retraction of

the coagulant (R, normal values 14-18mm), phase length of the formation of the coagulant (K, normal values 6-8mm), and maximum width of the coagulant (Angle normal value not over 40mm) at the high limit of reference values; but the maximum width between the two branches R and K (MA normal value 53-64mm) was lower than normal. The interpretation of the exam indicated a pathological coagulation profile with a reduced capacity for platelet aggregation. On the basis of the radiological finding and hemo-chemical exams we continued the conservative wide-spectrum antibiotic therapy with Meropenem, Levofloxacin, and Linezolid.

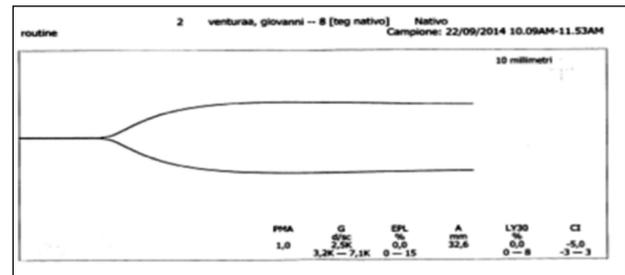


Fig 1: Tromboelastogram (TEG) 09/22/2014.

On the fourth day 09/23/2014 after suspending sedation and analgesia we planned on weaning the patient from the mechanical respiration. A/C ventilation was changed to pressure support ventilation (PSV). We began cycles of spontaneous breathing with a T-tube, and finally without EGA control we extubated the patient. The patient was afebrile, conscious, and well oriented in time and space. Hemodynamics were stable, still supported by infusion of noradrenalin at a dose of 0.08mcg/Kg/min. Diuresis was 0.4ml/Kg/h. The PCT was still high (Table 1). The morning TEG check revealed a high K value, while the Angle and MA were low (Fig. 2).

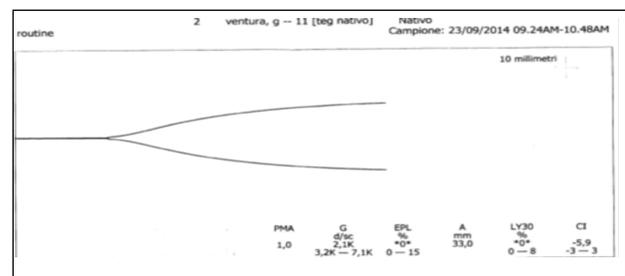


Fig 2: Tromboelastogram (TEG) 09/23/2014.

Interpretation of the graph confirmed the reduced capacity for platelet aggregation. The afternoon TEG revealed a significant improvement in the K values, the Angle, and a slightly reduced platelet function (Fig. 3).

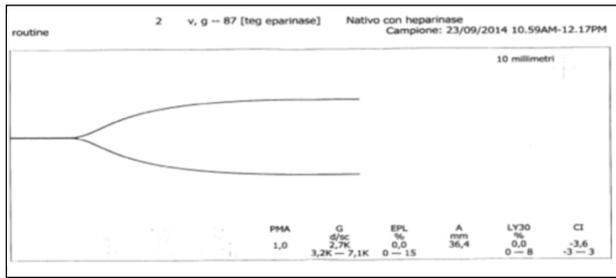


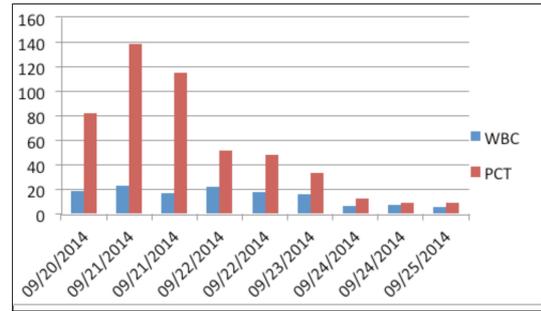
Fig 3: Tromboelastogram (TEG) 09/24/2014.

On the fifth day 09/24/2014 the patient was afebrile, well-oriented, alert and cooperative, breathing spontaneously, normal blood-gas exchange, stable hemodynamics, without support from any inotropics, normal abdomen on superficial and deep palpitation, diuresis present and strong. On the sixth day 09/25/2014 the patient underwent routine exams with normal values and was transferred to the urology department.

Discussion

This clinical case demonstrates that the hemocoagulation aspect is strongly influenced by the septic state. It’s well-known that alterations in the vascular endothelium are particularly important in the pathology of sepsis and disseminated intravascular coagulation (DIC), causing the production of thrombin that is deposited in the micro-circulation. The correlation between hemostatic equilibrium and inflammatory response is therefore highly relevant in the pathogenesis of severe inflammation⁽³⁾. Alteration of platelet aggregation is the usual indication of infection and is often associated with an unfavorable prognosis⁽⁴⁾. In our case TEG was an excellent indication of the septic state. The picture of systemic inflammation already present on admission to ICU was confirmed by a trend of increasing PCT as well as by a significant increase of WBC⁽⁵⁾. On the second day that biomarker reached 138pg, which clearly relates to the state of sepsis that the patient appeared to be suffering (graphic 1).

On the other hand, the TEG values were significantly altered relative to the low PTC and low MA values (33.6) that clearly and significantly correlate with the low number of platelets and their low function⁽⁵⁾. That TEG index indicates the strength of the coagulation and their interaction with fibrin. The high K value that represents the formation of coagulation indicates the slowing down of formation of coagulation itself and is strictly related to platelet function, plasma factors, and fibrinogen.



Graphic 1: Changes in WBC and PCT during hospitalization.

The TEG exam was particularly important and contributed to correcting pro-hemorrhage coagulation alterations due to the patient's septic state, which was confirmed by a significant decrease in fibrinogen on 09/22/2014 (Table 2).

DATE	9/20/2014	9/21/2014	9/22/2014	9/23/2014	9/24/2014	9/25/2014
TIME	8:00	8:00	11:00	8:00	18:00	8:00
FIBRINOGEN	200	211	141	135	189	237

Table 2: Changes in fibrinogen during hospitalization.

The hemochemical and other data in this clinical case confirm the use of TEG and PCT biomarkers in quickly indicating the correct therapy. The daily dosage of PCT was particularly useful and allowed us to offer the most appropriate antibiotic therapy even without any positive bacteriological exam. The wide-spectrum therapy cured the sepsis and ensured a successful outcome.

References

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