CASE REPORT Libri Oncol., Vol. 40 (2012), No 1-3, 7 – 9

THROMBELASTOGRAPHY IN DIAGNOSIS OF HYPERCOAGULABLE STATE IN CANCER PATIENTS – CASE REPORT

JELENA CULEJ[1], IRENA MIHIĆ LASAN[1], MARIJA SKOKO[1], GORANA KRAJAČIĆ KARAS[1], TIHA VUČEMILO[1] and DEANA ŠTURM[1]

[1] Department for Transfusion Medicine, University Hospital for Tumors, University Hospital Center Sestre milosrdnice, Zagreb, Croatia

Summary

Standard coagulation tests are plasma based and do not give complete information about coagulation in vivo. Thromboelastography is a test which allows coagulation testing in whole blood. It is useful in perioperative management of bleeding patients and results can be helpful in choice of therapy. Aim of our study was to compare thromboelastography results with standard coagulation test results in two patients. Thromboelastography results did not show any abnormalities and results of standard coagulation tests were in concordance with patient's therapy.

KEYWORDS: *thromboelastography, cancer, coagulation*

TROMBOELASTOGRAFIJA U DIJAGNOSTICI HIPERKOAGULABILNIH STANJA KOD PACIJENATA S KARCINOMOM-PRIKAZ SLUČAJA

Sažetak

Standardne koagulacijske pretrage koje se izvode iz plazme ne daju pravu informaciju o koagulaciji in vivo. Tromboelastografija je pretraga koja omogućava ispitivanje koagulacije u punoj krvi. Korisna je kao pretraga u perioperativnom praćenju bolesnika te može pomoći pri donošenju odluke o primjeni odgovarajuće terapije. Cilj ovog istraživanja bio je usporedtiti rezultate tromboelastografije sa standardni koagulacijskim pretragama kod dva pacijenta. Rezultati tromboelastografije nisu pokazali odstupanja koja bi ukazivala na patološki poremećaj, a rezultati standardnih koagulacijskih pretraga bili su karakteristični za pacijente na terapiji.

KLJUČNE RIJEČI: *tromboelastografija, karcinom, koagulacija*

INTRODUCTION

Tromboelastography (TEG) is a method which allows testing of haemostasis in full blood sample. Results of this test can detect various haemostatic disorders such as hypo- and hypercoagulability, fibrinolysis, clot strength and anticoagulant therapy (1).

Standard coagulation tests are performed in plasma with the cascade model describing fibrin formation in-vitro. Abnormalities in intrinsic and common pathways are detected by activated partial thromboplastin time (aPTT) while prothrombin time (PT) detects abnormalities in extrinsic and common pathway. This model suggests that these two pathways occur separately which is not the case in-vivo. New cell – based model of understanding coagulation includes cells and is described through three overlapping phases: initiation, amplification, and propagation (1). In con-

trast to standard coagulation tests, TEG measures clotting in whole blood which is based on interaction between protein coagulation cascade, platelets and fibrinogen (2).

MATERIAL AND METHODS

Two patients were selected. Patient 1 was 55 years old female with breast cancer. After second line of chemotherapy she developed thromboembolism of pulmonary artery. At the time when thromboelastography was performed patient was in therapy with warfarin. Patient 2 was 50 years old male with colon cancer and liver metastasis.

PT, aPTT, fibrinogen and thrombin time (TT) were analysed on Siemens BCS coagulation analyser, Siemens diagnostics with reagents provided by same manufacturer. Thromboelastography was performed on rotation thromboelastography analyser - ROTEM delta.

RESULTS

Thromboelastography was performed during standard preventive low molecular weight heparin (LMWH) therapy. Test results from both patients are shown in table 1 and table 2.

Parameters measured in INTEM and EXTEM test did not show any abnormalities, and further evaluation was not necessary. These results indicate normal coagulation process. Plasma based tests were in an accordance with patients condi-

Table 1.

TEG patient 1 - female								PLASMA BASED TEST		
	Test	Results	Ref. value		Test	Results	Ref. value	Test	Results	Ref.value
	CT	126s	100 – 240s		CT	86s	38 – 79s	PT%	37%	70 –130 %
	CFT	44s	30 – 110s		CFT	44s	34 – 159s	INR	1.80	
	α	81°	70° – 83°		α	81°	63° – 83°	Fib	3.4 g/L	2 – 4 g/L
	A10	66 mm	44 – 66 mm		A10	68 mm	43 –65 mm	aPTT	32 s	26 – 36 s
INTEM	A20	71 mm	50 – 71 mm	EXTEM	A20	72 mm	50 –71 mm	TT	19 s	14 – 21 s
	MCF	71 mm	50 – 72 mm		MCF	72 mm	50 –72 mm			

Throboelastography parameters: INTEM = intrinsic coagulation pathway, EXTEM = extrinsic coagulation pathway, CT = clotting time describes period from analysis start to first clot formation. CFT = clot formation time represents clot formation dynamics, α angle = describes clot formation kinetics, MCF = maximum clot firmness describes maximum firmness that clot achieves during analysis and it is also maximum amplitude, A10 and A20 are amplitudes after CT in defined time (10 and 20 minutes) and describe clot firmness at a given point.(3) Plasma based test parameters: PT = prothrombin time, INR = international normalized ratio, Fib = fibrinogen, aPTT = Activated partial thromboplastin time, TT = thrombin time.

Table 2.

TEG patient 2 - male								PLASMA BASED TEST		
	Test	Results	Ref. value		Test	Results	Ref. value	Test	Results	Ref.value
	CT	174 s	100 – 240 s		CT	61 s	38 – 79 s	PT %	68 %	70 –130 %
	CFT	68 s	30 – 110s		CFT	96 s	34 – 159 s	INR	1.30	
	α	76°	70° – 83°		α	71°	63° – 83°	Fib	1.8g/L	2 – 4 g/L
	A10	52 mm	44 – 66 mm		A10	51 mm	43 –65 mm	aPTT	48s	26 – 36 s
INTEM	A20	56 mm	50 – 71 mm	EXTEM	A20	57 mm	50 –71 mm	TT	26s	14 – 21 s
	MCF	56 mm	50 – 72 mm		MCF	57 mm	50 –72 mm			

Throboelastography parameters: INTEM = intrinsic coagulation pathway, EXTEM = extrinsic coagulation pathway, CT = clotting time describes period from analysis start to first clot formation. CFT = clot formation time represents clot formation dynamic, α angle = describes clot formation kinetics, MCF = maximum clot firmness describes maximum firmness that clot achieves during analysis and it is also maximum amplitude, A10 and A20 are amplitudes after CT in defined time (10 and 20 minutes) and describe clot firmness at a given point.(3) Plasma based test parameters: PT = prothrombin time, INR = international normalized ratio, Fib = fibrinogen, aPTT = activated partial thromboplastin time, TT = thrombin time.

tion. PT and INR results in patient 1 are characteristic finding during oral anticoagulant therapy, and prolonged aPTT in patient 2 is characteristic for heparin therapy.

DISCUSSION

Thromboelastography testing usually starts with INTEM and EXTEM, which can be explained as tests for intrinsic and extrinsic coagulation pathway. Reagents for INTEM contains ellagic acid and provide information similar to aPTT, which refers to coagulation factors XII, XI, IX, VII, X, II, I and points to fibrinolysis and platelet function. Reagent for EXTEM contains tissue factor and provides information similar to PT, which referes to coagulation factors VII, X, V, II, I, fibrinolysis and platelate function (4). Depending on abnormalities in these two initial tests, further testing is required. In our case none of the patients needed further testing, all parameters were within reference range.

The idea of using thromboelastography in predicting thromboembolic event after surgery relies on the fact that this is a global test which detects systematic changes caused by different coagulation disorders. According to previous studies the best time to predict postoperative thrombosis is early postoperative period but lack of quality studies leaves place for further investigation (1).

Thromboealstography is accepted in management of perioperative bleeding which allows quick diagnosis and decision making on subsequent therapy. Spalding et al. reported 40% cost reduction in using blood products and coagulation drugs (5). It was used as point of care test in study on patients during cardiac surgery which allowed better diagnosis and choice of therapy (6).

Coagulation system plays important role in malignancy. Chemotherapy and surgery are additional factors which may increase risk for deep vein thrombosis development. Papa et al. discussed the role of thromboelastography in management of cancer patients who underwent surgical procedure and pointed out that it could be helpful in targeting antithrombotic therapy (7).

CONCLUSION

In this case reports the use of thromboelastography in monitoring therapy did not provide better information than plasma based tests, which gave more precise information on patient condition. However, the potential role of this method in perioperative period was not assessed on a large group of patients. Therefore studies on cancer patients during perioperative period might provide more information.

REFERENCES

1. Smith S.A, The cell based model of coagulation. J Vet Emerg Crit Care (San Antonio) 2009;19(1):3-10.
2. Ustuner Z, Meltem Akay O, Keskin M, Kuş E, Bal C, Gulbas Z. Evaluation of coagulation dissorders in the use of bevacizumab for metastatic colorectal cancer. Med Oncol 2012; 29(5):3125-8.
3. Lang T, Bauters A, Braun S.L, Pötzsch B, von Pape K.W, Kolde H.J, Lakner M. Multi-centre investigation on reference ranges for ROTEM thromboelastometry. Blood Coagul Fibrinolysis. 2005;16(4):301-10.
4. http://www.practical-haemostasis.com/Miscellaneous/Miscellaneous%20Tests/teg.html
5. Spalding G.J, Hartrumpf M, Sierig T, Oesberg N, Kirschke C.G, Albes J.M. Cost reduction of perioperative coagulation management in cardiac surgery: value of "bedside" thrombelastography (ROTEM). Eur J Cardiothorac Surg 2007;31(6):1052-7.
6. Reinhöfer M, Brauer M, Franke U, Barz D, Marx G, Lösche W. The value of rotation thromboelastometry to monitor disturbed perioperative haemostasis and bleeding risk in patients with cardiopulmonary bypass. Blood Coagul Fibrinolysis. 2008;19(3):212-9.
7. Papa M.L, Capasso F, Pudore L, Torre S, Mango S, Russo V, Delrio P, Palaia R, Ruffolo F, d'Eufemia M.D, De Lucia D, Napolitano M, Di Micco P, Parisi V. Thromboelastographic profiles as a tool for thrombotic risk in digestive tract cancer. Exp Oncol 2007;29 (2):111-5.

Author's address: Jelena Culej, Department for Transfusion Medicine, University Hospital for Tumors, University Hospital Center Sestre milosrdnice, Zagreb, Croatia. E-mail: jelena.culej@gmail.com