RELATIONSHIP BETWEEN TEG INDEX AND ROUTINE COAGULATION TEST IN PATIENTS WITH COMMUNITY ACQUIRED PNEUMONIA IN EMERGENCY DEPARTMENT

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ABSTRACT

Objective: To investigate the relationship between TEG index and routine coagulation test in patients with community acquired pneumonia in Emergency Department.

Methods: Clinical data of 246 patients with community acquired pneumonia in Emergency Department were retrospectively chosen in the period from January 2017 to December 2019. The blood coagulation and TEG indexes in all patients were tested in the laboratory and the correlation between them were analyzed by Pearson method.

Results: There were no correlation between PT, Fib with R time in TEG index (r = 0.17, P = 0.10). There were significant correlation between R time in TEG index and APTT (r = 0.67, P = 0.00). There were significant correlation between K value in TEG index and Fib (r = -0.31, P = 0.00). There were significant correlation between α-Angle in TEG index and Fib (r = 0.48, P = 0.00). There was no correlation between MA in TEG index and Fib (r = 0.15, P = 0.12). There were significant correlation between K value in TEG index and PLT (r = -0.44, P = 0.00). There were significant correlation between α-Angle in TEG index and PLT (r = 0.51, P = 0.00). There were no correlation between MA value and PLT in TEG index (r = 0.10, P = 0.44). There were no correlation between R value, K value, α-Angle, MA value with D-D (r = 0.05, 0.28, 0.33, 0.19, P = 0.75, 0.18, 0.21, 0.35), neither with FDP (r = 0.60, 0.22, 0.37, 0.29, P = 0.66, 0.10, 0.18, 0.31).

Conclusion: There were the correlation between TEG detection indexes and four items of routine coagulation, but they could not replace each other.

Keywords: Emergency, community acquired pneumonia, TEG, coagulation function.

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Introduction

Community acquired pneumonia is one of the common infectious diseases in respiratory department. Patients can see obvious inflammatory injury of lung tissue, and some of them can be accompanied by systemic inflammatory reaction[1]. Studies have shown that inflammatory cells activate and release a variety of inflammatory mediators after inflammation, such as interleukin, tumor necrosis factor, and exist in the whole course of lung injury[2]. In recent years, studies have confirmed that there was a obvious disorder of coagulation function in patients with community-acquired pneumonia, which can affect the process of disease rehabilitation[3]. Thromboelastogram (TEG) detection has been carried out in many hospitals in China. Compared with traditional coagulation function detection indicators, there are significant differences in specimen types, detection

principles and methods[4]. However, whether there is a correlation between TEG detection indicators and conventional coagulation function indicators in patients with community-acquired pneumonia is still unclear, and the correlation between TEG detection indicators and age-related cataract is still unclear.

This paper retrospectively analyzed the clinical data of 246 patients with community-acquired pneumonia in the emergency department of our hospital from January 2017 to December 2019, in order to explore the relationship between TEG index and routine coagulation examination in emergency patients with community-acquired pneumonia.

Data and methods

Research objects

A total of 246 patients with community-acquired pneumonia in the emergency department of our hospital from January 2017 to December 2019 were included, including 158 males and 88 females, aged from 37 to 88 years, with an average age of 74.86±10.22 years.

Inclusion criteria:

• Meeting the diagnostic criteria of community-acquired pneumonia[5];

• Seeing a doctor in the emergency department of our hospital;

• Age ≥18 years old;

• Complete clinical data.

Exclusion criteria:

• Combined with diseases affecting blood coagulation function;

• Severe liver and kidney dysfunction;

• Mental system diseases;

• Unable to match relevant examinations.

The study protocol met the requirements of Helsinki declaration, and the patients and their families had informed consent.

Observation indexes

• Disease grading: according to the pneumonia severity index (PSI), the severity of the patients with pneumonia was graded as follows: grade I-II for ≤70, grade III for 71-90, grade IV for 91-130 and grade V for >130. Among them, grade I-II was mild, grade III was moderate, and grade IV-V was severe.

• Laboratory index detection: 3 mL of fasting peripheral venous blood was extracted for anticoagulation with sodium citrate, and TEG index and coagulation index were detected. TEG included reaction time (R value), coagulation formation rate (α

- angle), thrombin formation time (K value) and final coagulation intensity (Maximum Amplitude, MA value). The coagulation indexes included activated partial thromboplastin time (APTT), prothrombin time (PT), fibrinogen (FIB), platelets (PLT), D-Dimer (D-D), fibrin degradation products products (FDP). All tests were completed within 60 min.

TEG was detected by using TEG5000 Automatic Coagulation Analyzer (American haematoscope company). 1 mL sodium citrate anticoagulant whole blood was taken as the sample and flowed into the reaction tube along the wall. After screwing the bottle cap, the mixture was gently reversed for 5 times and avoid shaking the sample. 20 μL 0.2 mL/L calcium chloride solution was taken and added into TEG automatic analyzer for preheating, and then 340 μL whole blood was added and detected, and the curve of hypercoagulability-thromboelastography was recorded after MA value was determined.

Citric acid anticoagulant whole blood was used for the detection of four coagulation items mentioned abover, D-D and PDF testing. SysmexCA7000 automatic coagulation analyzer (Japan) was used for the classification of plasma after centrifugation, and Mindray CAL-7000 automatic hematology analyzer was used for the detection of PLT.

Statistical methods

SPSS 21.0 was used for statistical analysis. The measurement data was expressed with ($\bar{x}$±s).

The comparison between multiple groups was performed by one-Way ANOVA, and the pairwise comparison was performed by independent sample t-test, with P<0.05 as the difference was statistically significant. Pearson method was used for correlation analysis.

Results

Pt, APTT, FIB of patients with different severity

Among the 246 patients with community-acquired pneumonia, 118 were mild, 56 moderate and 72 severe. There were significant differences in PT, APTT and FIB among patients with different severity (P<0.05). See Table 1.

PLT, D-D, FDP of patients with different severity

There were significant differences in PLT, D-D and FDP among patients with different severity (P<0.05). See Table 2.

Patient	Numbers	PT (s)	APTT	FIB (g/L)
Mild	118	11.12±1.61#	29.29±4.38#	2.91±1.22#
Moderate	56	15.01±2.62*	40.78±6.97*	4.10±1.34*
Severe	72	21.76±3.74*#	52.43±7.58*#	4.97±1.52*#
F value		367.499	327.709	54.781
P value		0.000	0.000	0.000

Table 1: Comparison of Pt, APTT and Fib in patients with different disease severity (x̄±s).
*Note: compared with mild patients, *P<0.05; compared with moderate patients, #P<0.05.*

Patient	Numbers	PLT (×10⁹/L)	D-D (mg/L)	FDP (µg/mL)
Mild	118	194.01±34.66#	2.82±0.89#	2.86±0.56#
Moderate	56	152.34±30.12*	7.74±2.10*	3.62±0.72*
Severe	72	63.87±8.79*#	15.14±4.20*#	4.38±0.83*#
F value		471.185	519.606	111.566
P value		0.000	0.000	0.000

Table 2: Comparison of PLT, D-D and FDP in patients with different disease severity (x̄±s).
*Note: compared with mild patients, *P<0.05; compared with moderate patients, #P<0.05.*

TEG index of patients with different disease severity

There were significant differences in R value, MA value, α angle and K value among patients with different severity (P<0.05). See Table 3.

Patient	Numbers	R value	MA value	α angle	K value
Mild	118	3.91±0.85#	68.12±7.11#	75.93±7.22#	1.20±0.26#
Moderate	56	5.62±1.18*	58.67±6.56*	65.48±6.59*	2.24±0.41*
Severe	72	9.89±2.51*#	48.79±6.31*#	54.82±7.01*#	3.69±0.73*#
F value		321.998	184.883	204.789	613.447
P value		0.000	0.000	0.000	0.000

Table 3: Comparison of TEG indexes in patients with different disease severity (x̄±s).
*Note: compared with mild patients, *P<0.05; compared with moderate patients, #P<0.05.*

Correlation analysis of coagulation four indexes and TEG index levels in laboratory

R value in TEG index was significantly correlated with APTT (r = 0.67, P = 0.00); K value in TEG index was significantly correlated with FIB (r = - 0.31, P = 0.00); α - angle in TEG index was significantly correlated with FIB (r = 0.48, P = 0.00); see table 4.

Index	PT		APTT		Fib	
	r	P	r	P	r	P
R value	0.17	0.10	0.67	0.00	0.23	0.14
K value	0.19	0.08	0.26	0.14	-0.31	0.00
α-Angle	0.35	0.16	0.30	0.25	0.48	0.00
MA value	0.24	0.33	0.17	0.39	0.15	0.12

Table 4: Correlation Analysis of PT, APTT, Fi and TEG index levels.

Correlation analysis of PLT, D-D, FDP and TEG index level

In TEG, K value was significantly correlated with PLT (r = - 0.44, P = 0.00). In TEG, α - angle was significantly correlated with PLT (r = 0.51, P = 0.00); R value, K value, α - angle and MA value were not correlated with D-D (r = 0.05, 0.28, 0.33, 0.19, P = 0.75, 0.18, 0.21, 0.35); nor was FDP (r = 0.60, 0.22, 0.37, 0.29, P = 0.66, 0.10, 0.18, 0.31). See Table 5.

Index	PLT		D-D		FDP	
	r	P	r	P	r	P
R value	0.17	0.39	0.05	0.75	0.60	0.66
K value	-0.44	0.00	0.28	0.18	0.22	0.10
α-Angle	0.51	0.00	0.33	0.21	0.37	0.18
MA value	0.10	0.44	0.19	0.35	0.29	0.31

Table 5: Correlation Analysis of PLT, D-D, FDP and TEG index levels.

Discussion

Inflammatory response and hypoxia in patients with community-acquired pneumonia can lead to pulmonary vascular endothelial cell injury, activation of coagulation system, and further induce coagulation dysfunction[6]. It has been confirmed that inflammatory reaction and coagulation function can interact with each other. After inflammatory reaction occurs, a variety of inflammatory mediators are synthesized, secreted and released in human body, among which plasma derived inflammatory mediators can affect coagulation function from multiple links, such as coagulation, fibrinolysis, kinin/complement system, etc[7].

When the human tissue is injured, the coagulation pathway is activated at the same time, both endogenous and exogenous, and a large amount of thrombin is formed and the coagulation cascade reaction is significantly enhanced[8]. In severe cases,

it leads to thrombosis or microcirculation disturbance of multiple organs[9]. Some scholars have reported that patients with severe community-acquired pneumonia can develop sepsis, ALI/ARDS or even MODS, if their condition is not controlled in time, which is a serious threat to life safety. The traditional laboratory test indexes of coagulation function mainly include four items of coagulation, PLT, D-D and FIB[10]. In recent years, TEG has been gradually used in the detection of coagulation function. Among the main parameters, R value reflects coagulation factor activity, K value and α - angle reflect fibrinogen level/partial platelet function, MA reflects maximum clot strength. It is considered that TEG test is more comprehensive than traditional coagulation function test in reflecting coagulation function[11]. This study analyzed the clinical data of 246 patients with community-acquired pneumonia in our hospital from January 2017 to December 2019, and analyzed the correlation between laboratory coagulation function and TEG index. K value and α - angle in TEG can directly reflect the clot rate, which is mainly affected by Fib and PLT. In this study, K value and α - angle in TEG detection are respectively related to Fib and PLT, and the correlation is the highest. There was no correlation between MA and Fib (r = 0.15, P = 0.12) or PLT (r = 0.10, P = 0.44). MA mainly reflects the maximum blood clot strength, and its level is related to the interaction between PLT and Fib. The author thought that there is no correlation between MA value and PLT and Fib level in TEG detection in this study, and it may be related to MA mainly reflecting PLT aggregation function. Previous studies have confirmed that PLT aggregation function is related to PLT function in addition to quantity.

After pulmonary inflammation, only the activated PLT can synthesize and release a variety of active substances, and participate in hemostasis and coagulation reaction. In addition to vascular endothelial damage can lead to PLT adhesion activation, some microorganisms and metabolic toxins can also induce PLT activation[13]. PLT count alone can only reflect the number of platelets, but not the function of platelet aggregation activity, which weakens the correlation between them[14]. D-D mainly reflects the formation of blood clots in the vascular circulation system. The increase of D-D level indicates that the activity of coagulation and fibrinolysis in vivo is enhanced, which can be used as an important marker of acute thrombosis, but the specificity is relatively poor[15]. PLT can activate internal and external coagulation pathways, activate

coagulation factors, enhance coagulation function, increase platelet consumption in patients with pneumonia, and reduce PLT. FDP is the product of fibrinogen or fibrin under the action of fibrinolytic enzyme. The increase of FDP level indicates hyperfibrinolysis. The results showed that R value, K value, α - angle and MA value had no correlation with D-D (r = 0.05, 0.28, 0.33, 0.19, P = 0.75, 0.18, 0.21, 0.35) and there was no correlation with FDP (r = 0.60, 0.22, 0.37, 0.29, P = 0.66, 0.10, 0.18, 0.31), which was consistent with the results reported in the past[16]. The author believed that the R value, K value, α - angle and MA value had no correlation with D-D in order to further explore the significance of TEG and routine coagulation function test indicators, the above two indicators should be combined to realize the comprehensive evaluation of fibrinolytic system function. To sum up, TEG detection indexes of emergency patients with community-acquired pneumonia are correlated with the four items of routine coagulation, but they can not replace each other, and D-D and FDP are difficult to be used in the evaluation of hyperfibrinolysis. However, this study belongs to a single center, small sample retrospective report, there may be selection bias, so it needs to be confirmed by further research.

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