TAT, PIC, TM, и t-PAIC комплексы в диагностике и прогнозе тромбоэмболических осложнений

TAT, PIC, TM, and t-PAIC complexes in diagnostics and prognosis of thromboembolic complications

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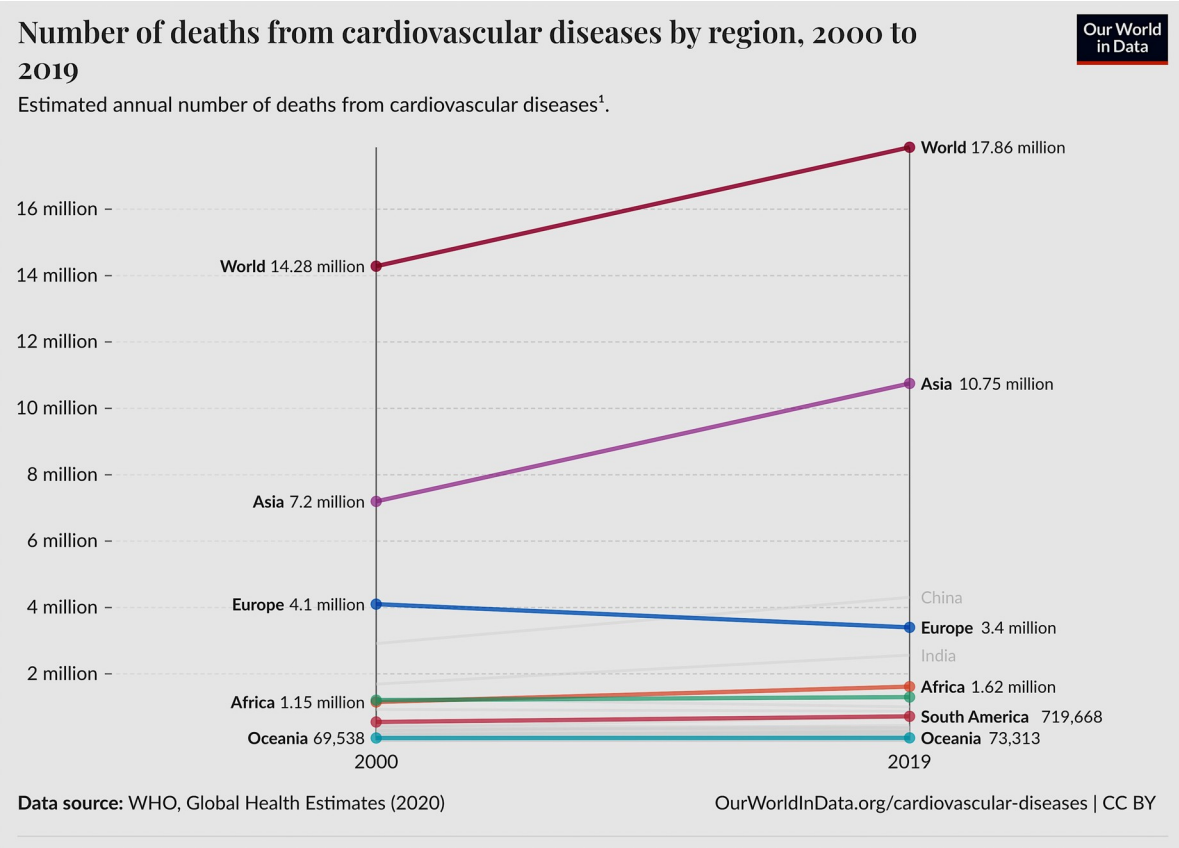
клинической лабораторной диагностике

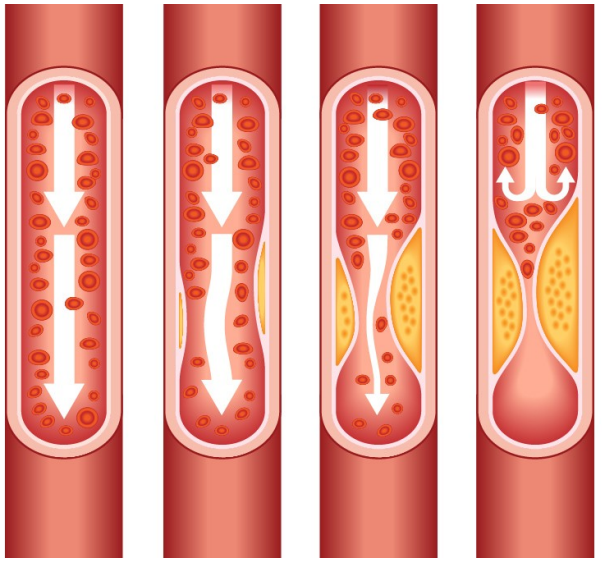
Выступление поддержано компанией Snibe

Мнение докладчика независимо

Сердечно-сосудистые заболевания являются наиболее распространенной причиной смерти во всем мире



https://ourworldindata.org/



https://www.cdc.gov/heart-disease

Сердечно -сосудистые заболевания ассоциированы с расстройствами гемостаза, эндотелиальной дисфункцией и воспалением

Распространенность сердечно-сосудистых заболеваний в РФ

Смертность в 2023 году (янв-апрель) снизилась на 18,5% по сравнению с тем же периодом 2022 года

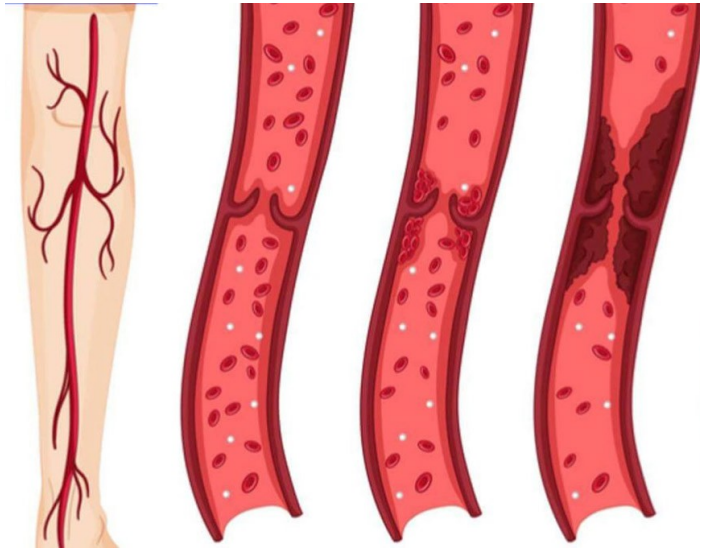
https://rosstat.gov.ru/folder/313/document/209097

Снижение госпитальной летальности от ОИМ и ОНМК

Из доклада вице-премьера Правительства РФ Голиковой Т.А. на Коллегии Минздрава 16 мая 2025 г.

Актуальность ВТЭО осложнений очевидна

- ✓ Ежегодная заболеваемость ВТЭО:
  - ТГВ - 50–100 на 100 тыс. популяции
  - ТЭЛА - 75–150 случаев на 100 тыс. популяции.
- ✓ Индивидуальная заболеваемость удваивается каждые 10 лет жизни.
- ✓ Частота рецидивов ТГВ
  - при неспровоцированном тромбозе - 10% в первый год и 25% через 5 лет,
  - при спровоцированном тромбозе - 5% и 15% соответственно,
- ✓ 4% случаев летальных исходов при рецидивах



https://www.google.com/search

Селиверстов Е.И., Лобастов К.В., Илюхин Е.А. и др. Флебология. 2023; 17 (3): 152–296. https://doi.org/10.17116/flebo202317031152.
Clin Appl Thromb Hemost. 2013; 19 (2): 116–8. https://doi.org/10.1177/1076029612474840.
Darzi A.J., Karam S.G., Charide R., et al. Blood. 2020; 135 (20): 1788–810. https://doi.org/10.1182/blood.2019003603.
Anderson D.R., Morgano G.P., Bennett C., et al Blood Adv. 2019; 3 (23): 3898–944. https://doi.org/10.1182/bloodadvances.2019000975.
Schünemann H.J., Cushman M., Burnett A.E., et al. Blood Adv. 2018; 2 (22): 3198–225. https://doi.org/10.1182/bloodadvances.2018022954.
Nicolaides A.N., Fareed J., Spyropoulos A.C., et al. Int Angiol. 2024; 43 (1): 1–222. https://doi.org/10.23736/S0392-9590.23.05177-5.
Duranteau J., Taccone F.S., Verhamme P., Ageno W. Eur J Anaesthesiol. 2018; 35 (2): 142–6. https://doi.org/10.1097/EJA.0000000000000707.
Gee E.. Br J Haematol. 2019; 186 (5): 792–3. https://doi.org/10.1111/bjh.16010.
Encke A., Haas S., Kopp I. Dtsch Arztebl Int. 2016; 113 (31–32): 532–8. https://doi.org/10.3238/arztebl.2016.0532

Ежегодная частота ВТЭО с поправкой на возраст и пол за период с 1981 по 2010 гг. существенно не изменилась [12].

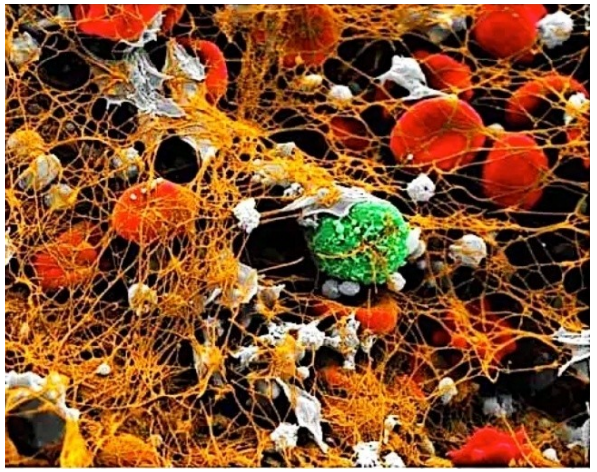
Heit J.A., Ashrani A., Crusan D.J., et al. Reasons for the persistent incidence of venous thromboembolism. Thromb Haemost. 2017; 117 (2): 390–400. https://doi.org/10.1160/TH16-07-0509

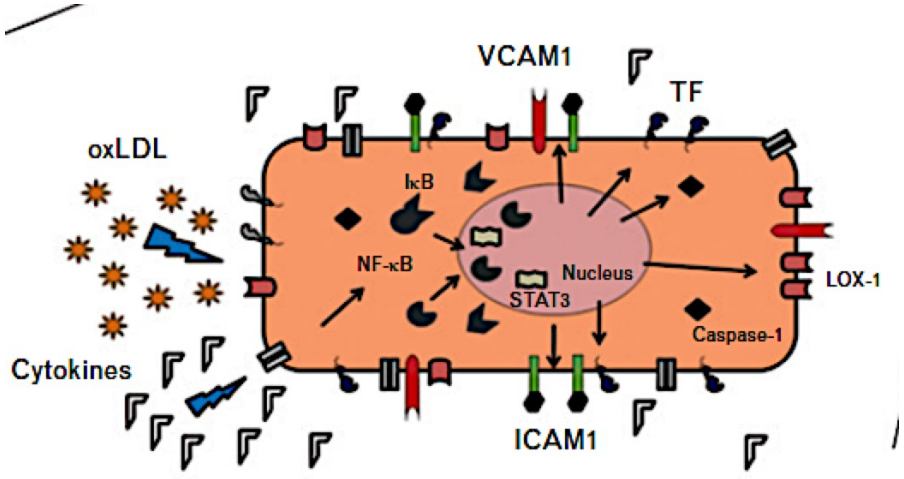
Лабораторные маркеры для:

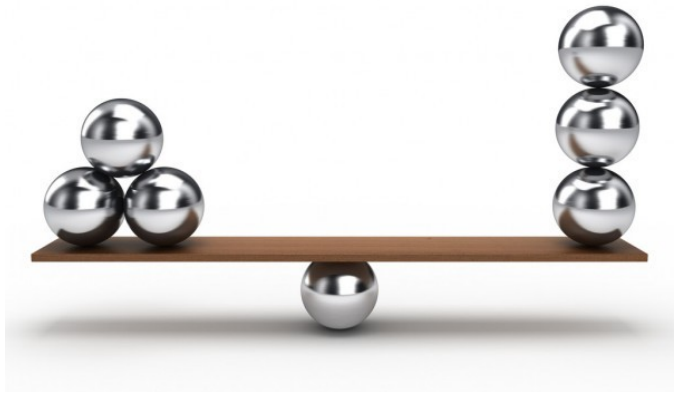
- ✓ Диагностики
- ✓ Контроля терапии
- ✓ Оценки риска
- ✓ Прогноза

Сердечно-сосудистые заболевания и активация процессов гемостаза

- ✧ Снижение антикоагулянтных свойств эндотелия – атеросклероз, венозный тромбоз...
- ✧ Активация тромбоцитов - микротромбоз, артериальный тромбоз...
- ✧ Дисбаланс про- и антикоагулянтных белков плазмы - венозный и внутрисердечный тромбоз



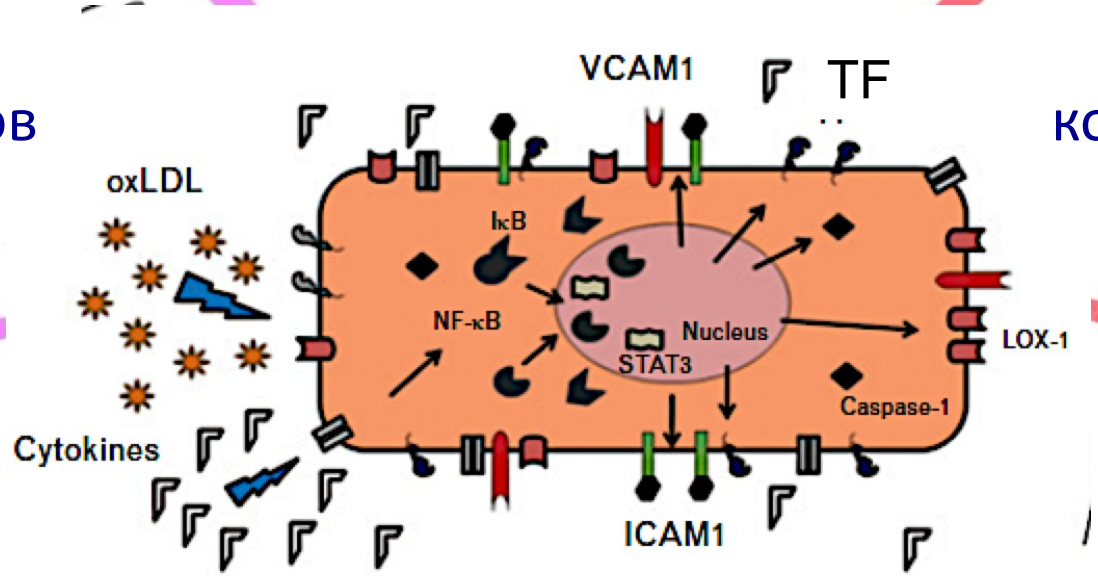




G. Cimmini et al. J Cardiovasc Med 2023, 24 (suppl 2):e156–e167
DOI:10.2459/JCM.0000000000001450

Сердечно -сосудистые заболевания ассоциированы с расстройствами гемостаза, эндотелиальной дисфункцией и воспалением

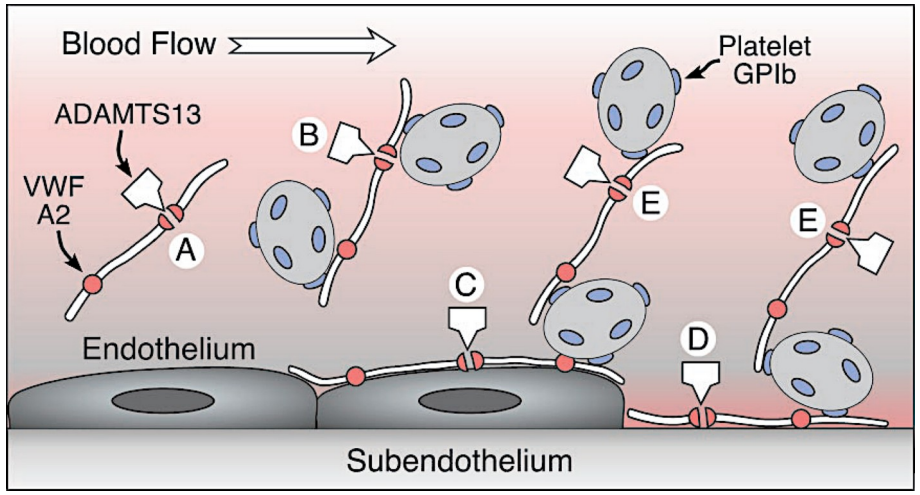
Аактивация тромбоцитов



Запуск коагуляционного каскада

Дисбаланс системы фибринолиза

Фактор Виллебранда – маркер дисфункции эндотелия



- ✓ Первичный гемостаз – vWF участвует в процессах адгезии и агрегации тромбоцитов.
- ✓ Плазменный гемостаз – vWF транспортирует и защищает от разрушения фазу VIII.
- ✓ Расщепляется металлопротеиназой ADAMTS-13 (↓– тромботическая тромбоцитопеническая пурпура)

Sadler JE. A new name in thrombosis, ADAMTS13. ProcNatl AcadSciU S A. 2002;99(18):11552-11554. doi:10.1073/pnas.192448999

vWF демонстрирует увеличение при сердечно-сосудистых заболеваниях на фоне дисфункции и повреждения эндотелия

Связь между повышением маркеров активации и риском повторных цереброваскулярных событий

Повторные сердечно-сосудистые события развились в 23,9% случаев (130 пациентов, 5 лет наблюдения)[1]

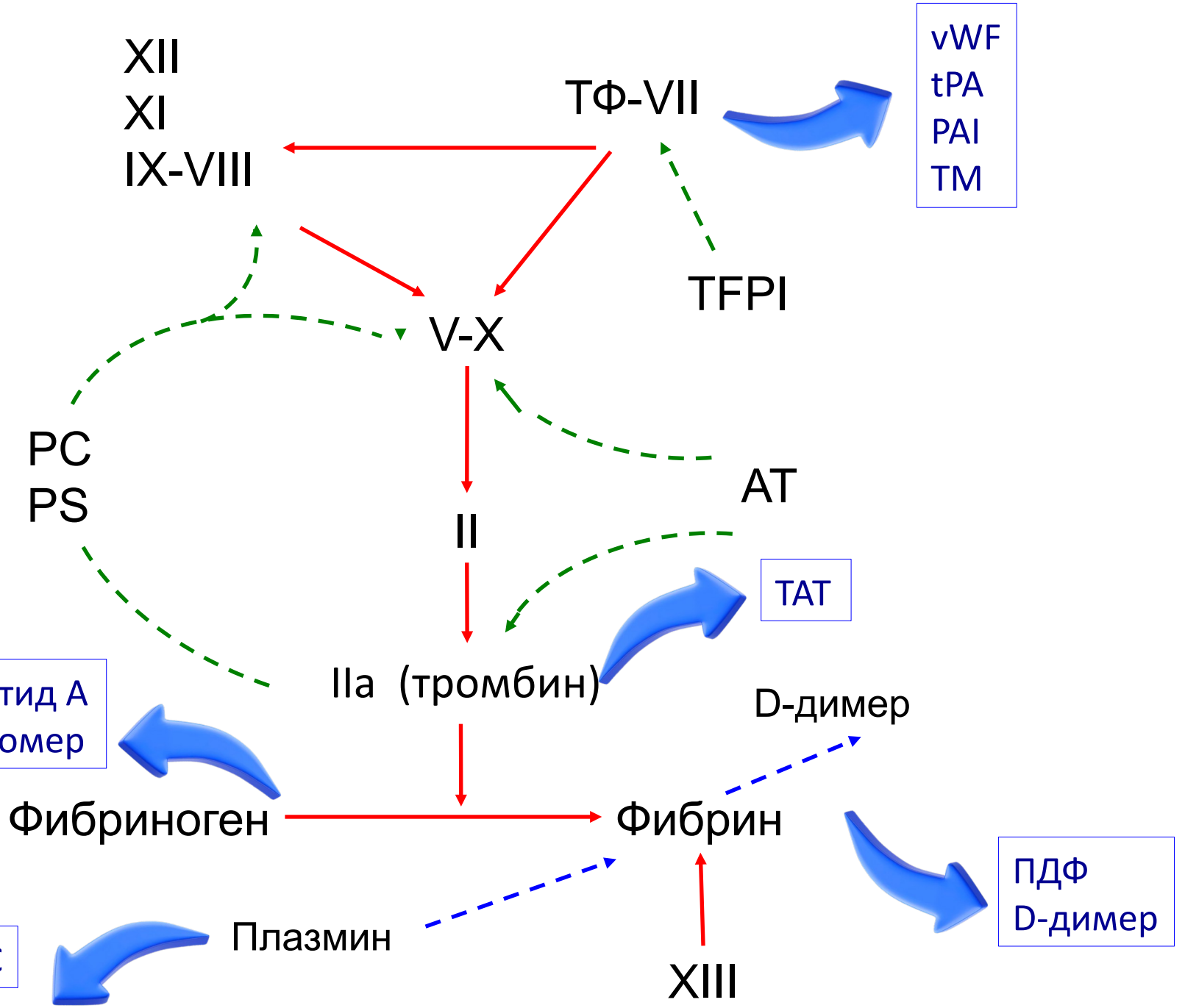
Лабораторный маркер	Риск повторного события, OR [95% CI]
Factor VIII activity, %	6,33 [95% CI 2,23-17,98]
Fibrinogen, g/l	2,63 [95% CI 1,06-5,42]
vWF:Ag , %	2,39 [95% CI 1,00-6,92]

RR для ТГВ у пациентов с высоким vWF:Ag составил 3,80 (95% ДИ 1,15–12,48, p = 0,028)[2]

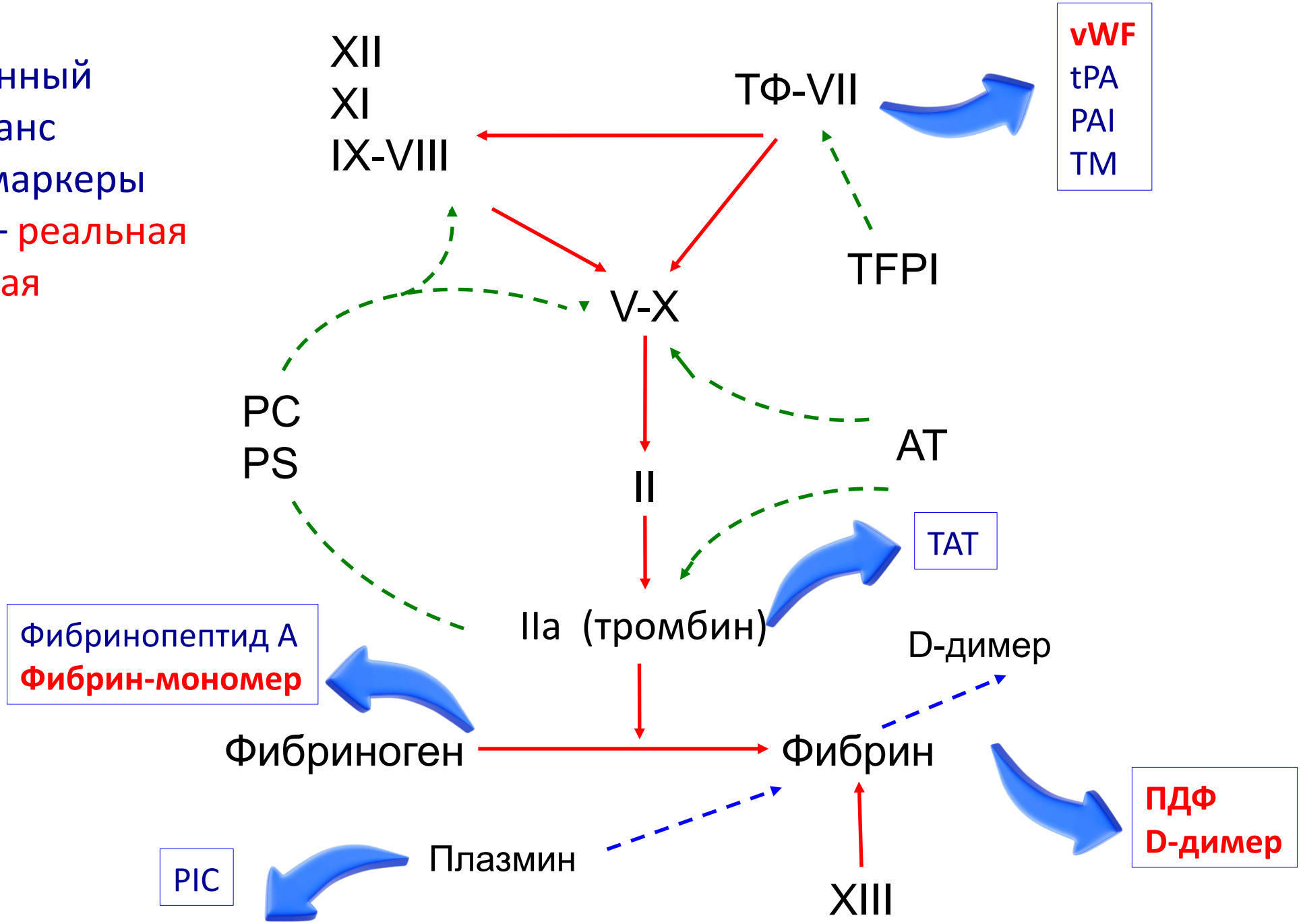
Более высокие концентрации vWF и FVIII в плазме у лиц с не-О группой крови связаны с более высоким риском ИБС, ВТЭ[3] и ИМ[4]

[1]Markers of blood coagulation activation in clinical and laboratory practice / T.V. Vavilova, O.O. Belyavskaya // Practical medicine. Modern diagnostic issues. – 2014. – No. 3 (79). – pp. 208-213.
[2]Setiawan et al. Thrombosis Journal (2020) 18:33 https://doi.org/10.1186/s12959-020-00247-6
[3]D. J. Anstee, “The relationship between blood groups and disease,” Blood, vol. 115, no. 23, pp. 4635–4643, 2010.
F. Yamamoto, et al “ABO Research in the Modern Era of Genomics,” Transfusion Medicine Reviews, vol. 26, no. 2, pp. 103–118, 2012.

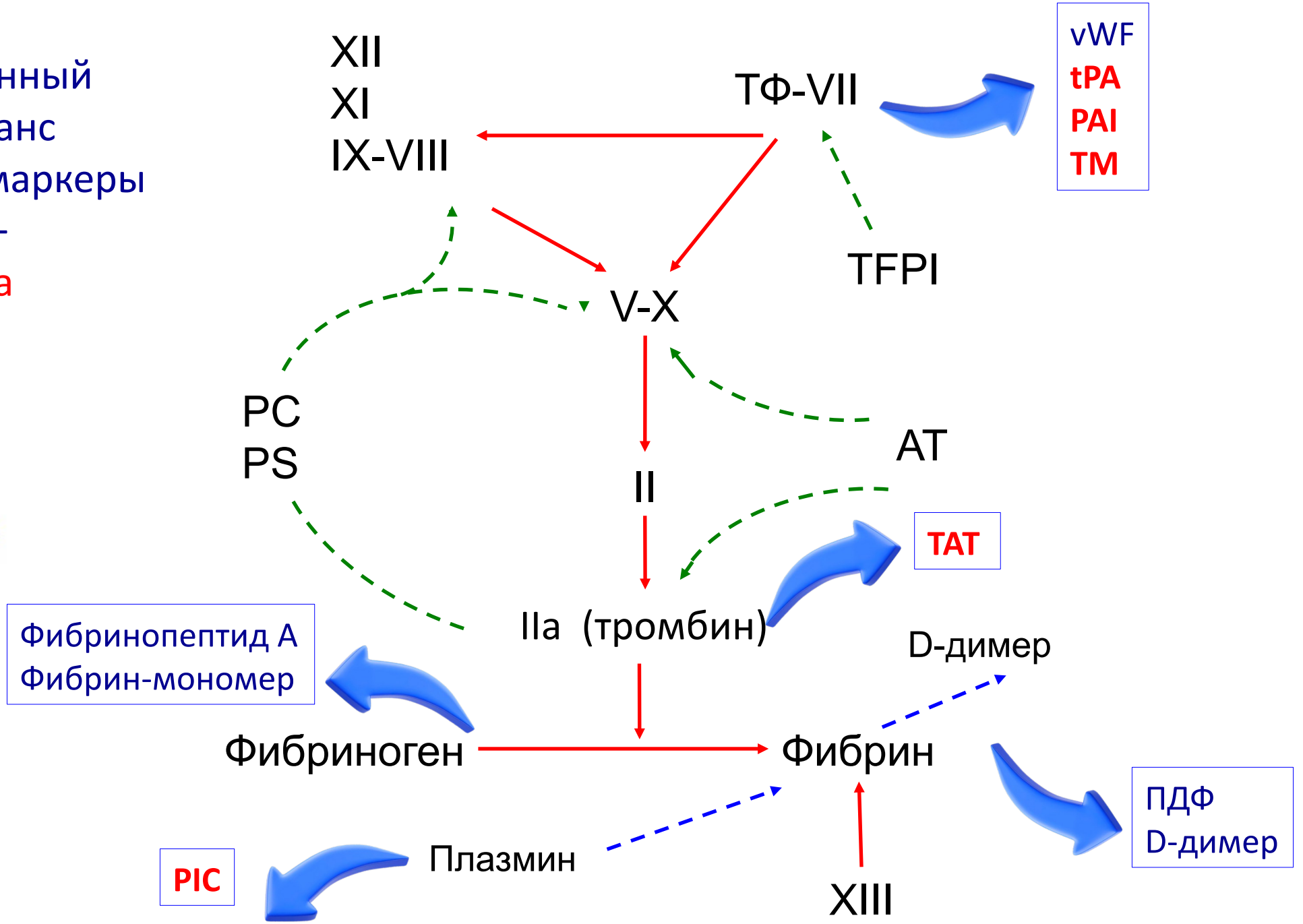
Коагуляционный каскад, баланс реакций и маркеры активации – фундаментальные знания

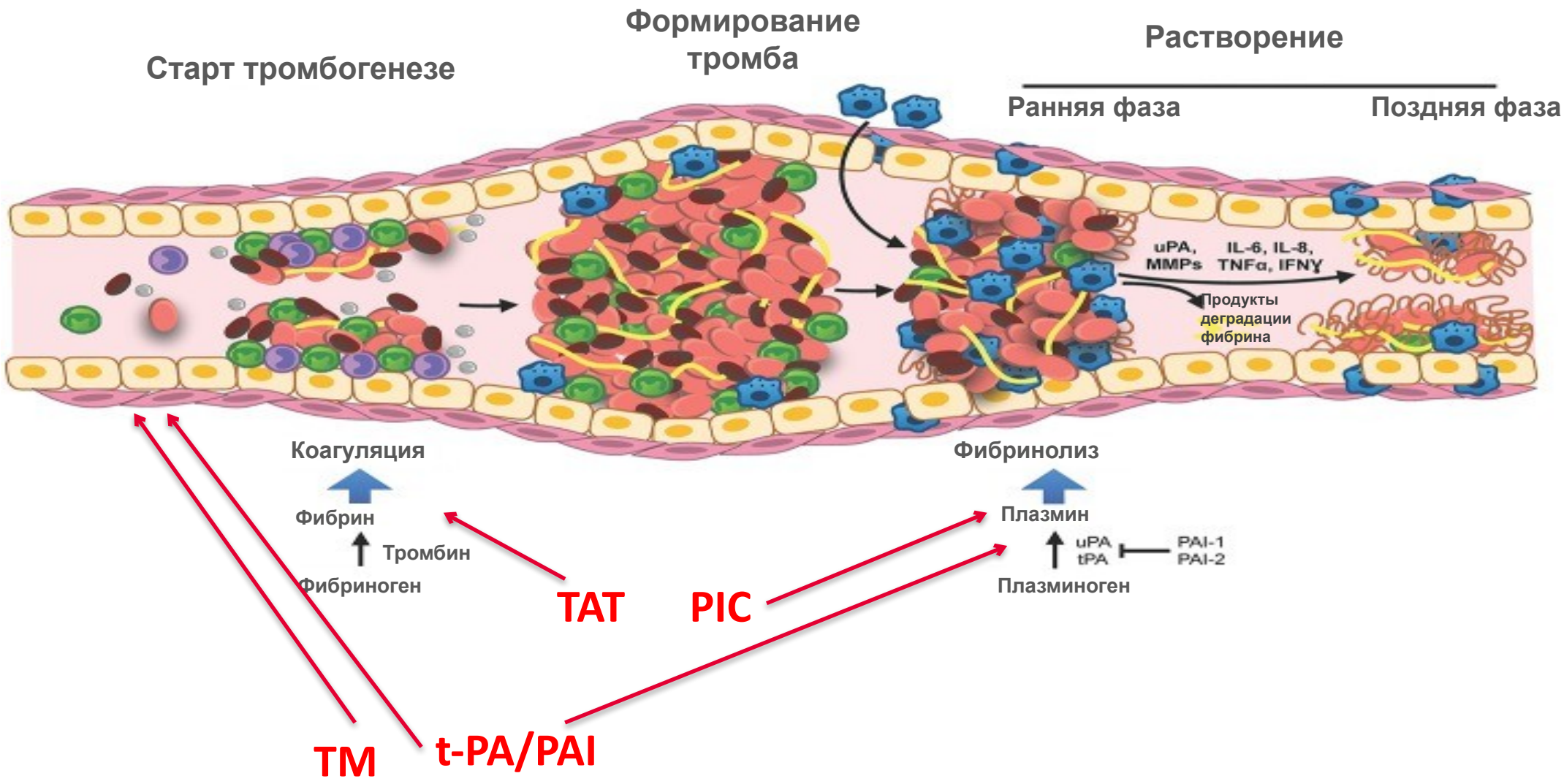


Коагуляционный каскад, баланс реакций и маркеры активации – реальная лабораторная практика



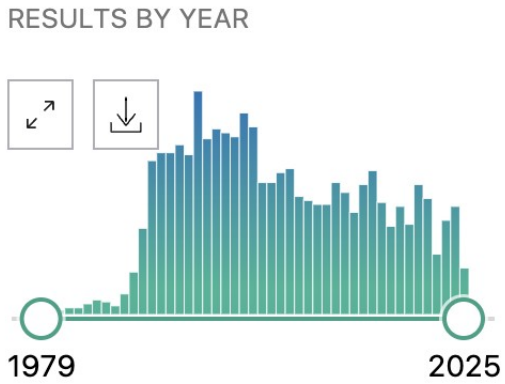
Коагуляционный каскад, баланс реакций и маркеры активации – перспектива



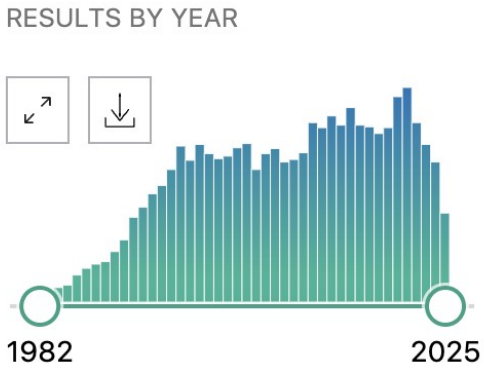


Новые возможности – новые горизонты

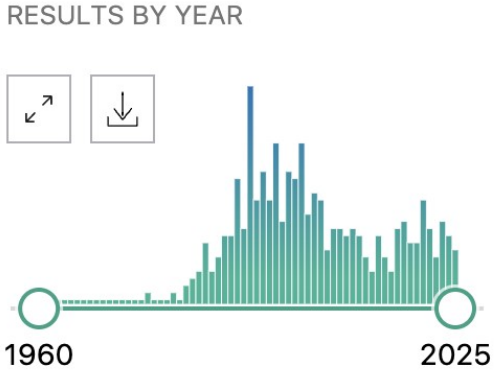
TAT - thrombin antithrombin complex
2232



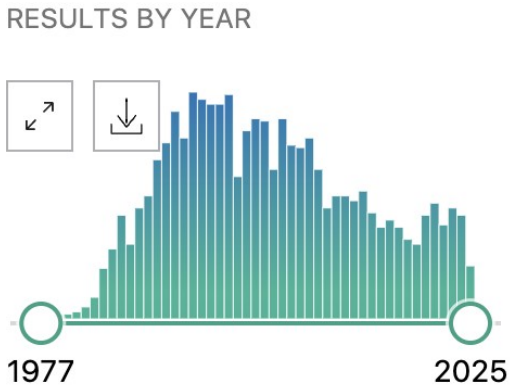
TM – thrombomodulin
5797



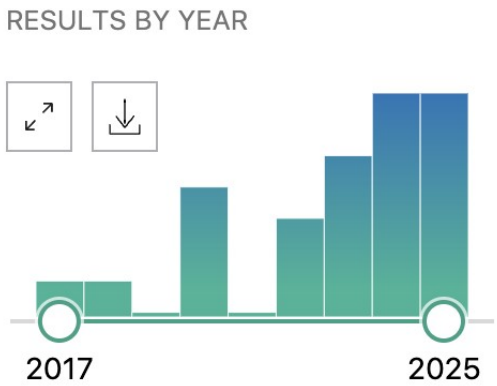
PIC - plasmin-α2-plasmin inhibitor complex
439



T-PAIC - tissue plasminogen activator-inhibitor complex
2217



TAT, PIC, TM, and t-PAIC; n=27



Новый комплекс 4-х маркеров – клиническое значение (2017)

Оценены – тромбомодулин (TM) / комплексы тромбин-антитромбин (TAT) / комплексы α2-плазминовый ингибитор-плазмин (PIC) / комплексы тканевого активатора плазминогена-ингибитора активатора плазминогена (t-PAI/PAI) / D-димер / ПДФ] у пациентов в критическом состоянии с ТЭЛА (n=38) и без ТЭЛА (n=81), их корреляцию с воспалительными маркерами (прокальцитонин/СРБ/интерлейкин-6)

У пациентов в критическом состоянии с ТЭЛА наблюдается более высокий системный воспалительный ответ, сопровождающийся нарушением коагуляции. Существует сетевая связь между воспалением и коагуляцией, взаимодействие воспалительных факторов с показателями коагуляции способствует тромбоэмболии и воспалению.

Zhongguo Shi Yan Xue Ye Xue Za Zhi. 2017 Dec;25(6):1776-1780.
doi: 10.7534/j.issn.1009-2137.2017.06.036.

[Clinical Significance of Coagulation Indicators and their Correlation with Inflammatory Factors in Critical Patients with Thromboembolism]

[Article in Chinese]
Yang Fu [1], Ya-Xiong Jin [1], Yu-Mei Liu [1], Qian Niu [1], Hong Jiang [2]

Affiliations + expand

PMID: 29262915 DOI: 10.7534/j.issn.1009-2137.2017.06.036

Abstract

Objective: To evaluate the levels of coagulation indicators [thrombomodulin(TM)/ thrombin-antithrombin complexes(TAT)/ α_2-plasmin inhibitor-plasmin complexes(PIC)/ tissue plasminogen activator-inhibitor complexes(t-PAIC) /D-Dimer(D-D)/fibrin degradation products(FDP)] in the critical patients with thromboembolism, analyse their correlation with inflammatory factor (procalcitonin/C reactive protein/ interleukin-6), and explore the diagnostic significance of coagulation indicators for these patients.

Methods: The serum levels of the coagulation indicators (TM/TAT/PIC/t-PAIC/D-D /FDP) and inflammatory factors (PCT/IL-6/CRP) were detected in the patient group with critical thromboembolism (n= 38) and critical patient group without thromboembolism as control (n= 81) . The correlation of coagulation indicators with inflammatory factors was analyzed.

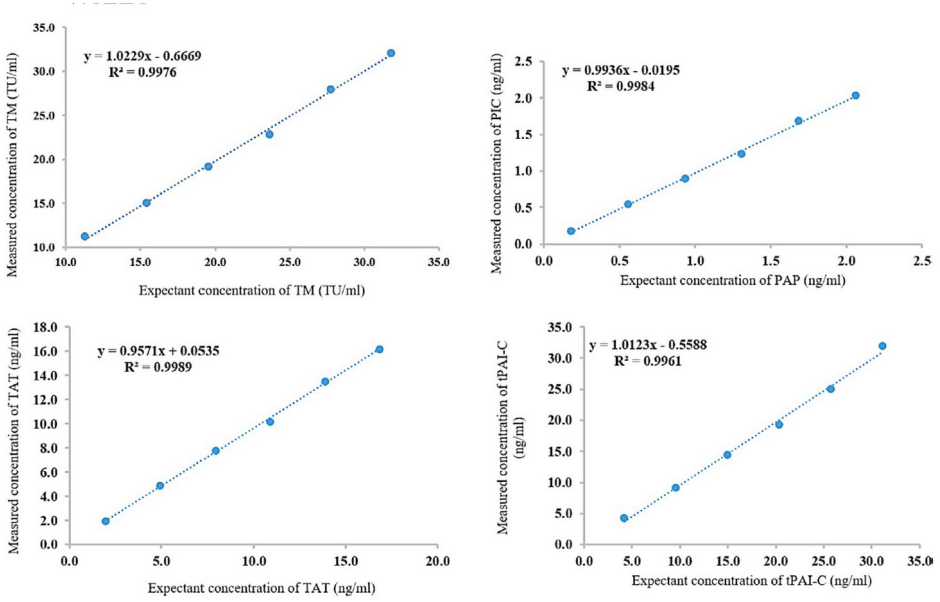
Results: The values of TM/TAT/PIC/D-D/FDP in thromboembolism group were statistically significantly higher than those in control group (P<0.05). However, the t-PAIC values were not significantly different (P>0.05), and 3 inflammatory factors (PCT/CRP/IL-6) in thromboembolism patients were significantly higher than those in control group (P<0.05). The correlation analysis suggested that the correlation coefficients of TM with PCT, CRP and IL-6 were 0.288, 0.249 and 0.270, respectively (P<0.05).

Conclusion: The critical patients with thromboembolism show an obviously higher systemic inflammatory response, and accompany with coagulation dysfunction. There is a network relationship between inflammation and coagulation, the interaction of inflammatory factors with coagulation indicators promotes thromboembolism and inflammation.

Верификация исследований тромбомодулина, комплекса тромбин-антитромбин, комплекса плазмин-α2-антиплазмин и комплекса t-PA: PAI-1

Метод:
Высокочувствительный хемилюминесцентный анализ HISCL-5000 Analyzer

Воспроизводимость: серия измерений TM, TAT, PAP, and tPAI-C на трех уровнях концентрации: CV 1,26 – 4,31 %



Линейность калибровочных кривых для TM, TAT, PAP и tPAI-C

DOI: 10.1002/jcla.22913

RESEARCH ARTICLE

WILEY

Performance evaluation of thrombomodulin, thrombin-antithrombin complex, plasmin-α2-antiplasmin complex, and t-PA: PAI-1 complex

Qian Chen[1] | Weiling Shou[1] | Wei Wu[1] | Geng Wang[1] | Wei Cui[1,2]

[1]Department of Clinical Laboratory, Peking Union Medical College Hospital, Peking Union Medical College and Chinese Academy of Medical Sciences, Beijing, China

[2]Department of Clinical Laboratory, Cancer Hospital Chinese Academy of Medical Sciences, Beijing, China

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Funding information
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Abstract

Background: To conduct a comprehensive performance evaluation of a fully automated analyzer for measuring thrombomodulin (TM), thrombin-antithrombin complex (TAT), plasmin-α2-antiplasmin complex (PAP), and t-PA: PAI-1 complex (tPAI-C).

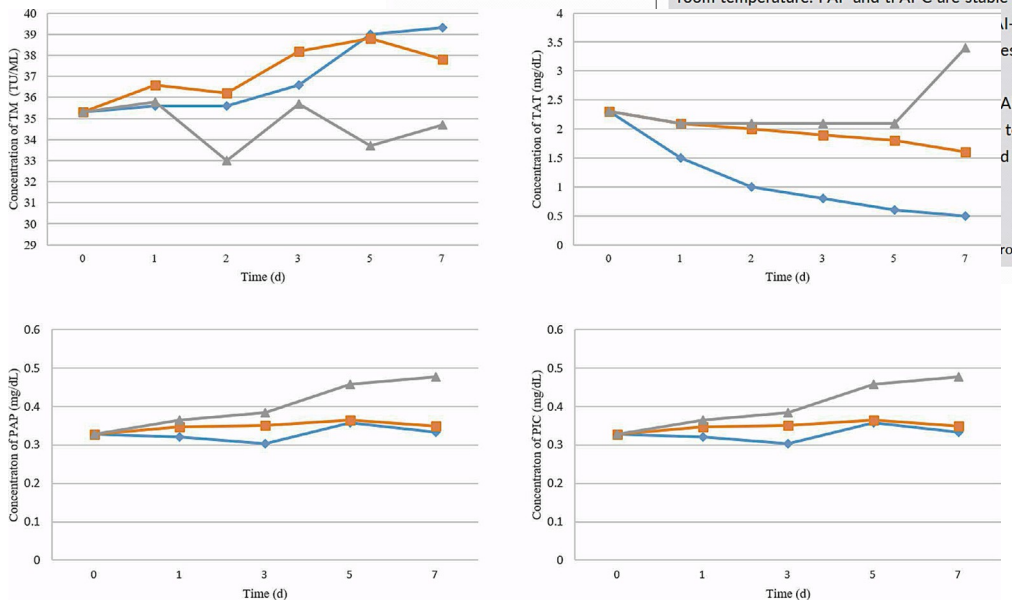
Methods: According to the Clinical and Laboratory Standards Institute (CLSI) EP05-A2, EP06-A specifications, TM, TAT, PAP, and tPAI-C were analyzed to evaluate intraassay variability and interassay variability, linear range, carryover rate, reference range, sample stability, and interferences.

Results: The intraassay variability and interassay variability of the four factors were all below 5%. The carryover rates were below 1%. Linear verification analysis revealed correlation coefficients of 0.998-0.999. The recommended reference ranges of TM, TAT, and PAP were appropriate for our laboratory, whereas the reference of tPAI-C should be established by each laboratory. Stability assessment revealed that TM is stable for 2 days at room temperature but lacks stability at colder temperatures. In contrast, TAT is stable for 5 days at 4°C and −20°C but has poor stability at room temperature. PAP and tPAI-C are stable for 3 days at all three temperatures.

...I-C is not altered by the presence of ...es, or 21.1 mg/dL conjugated and free ...

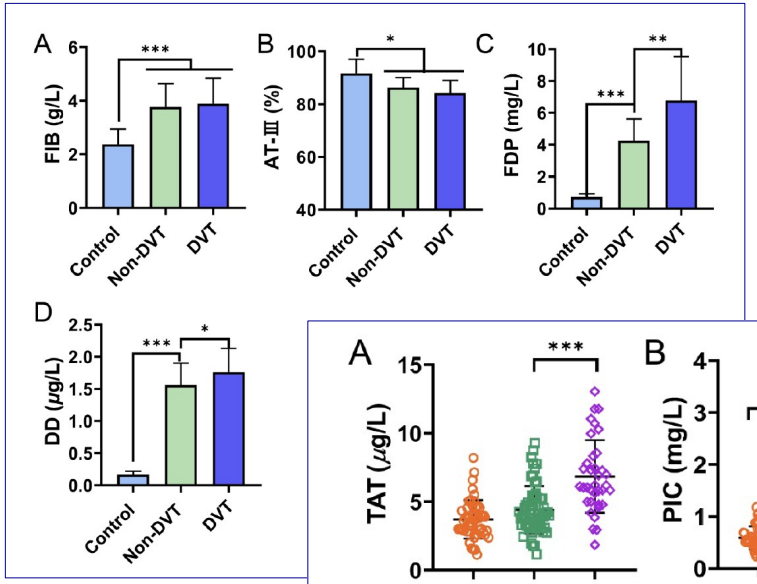
...AP, and tPAI-C using a high-sensitivity ... terms of precision, carryover rate, lin... ...d is suitable for the detection of these ...

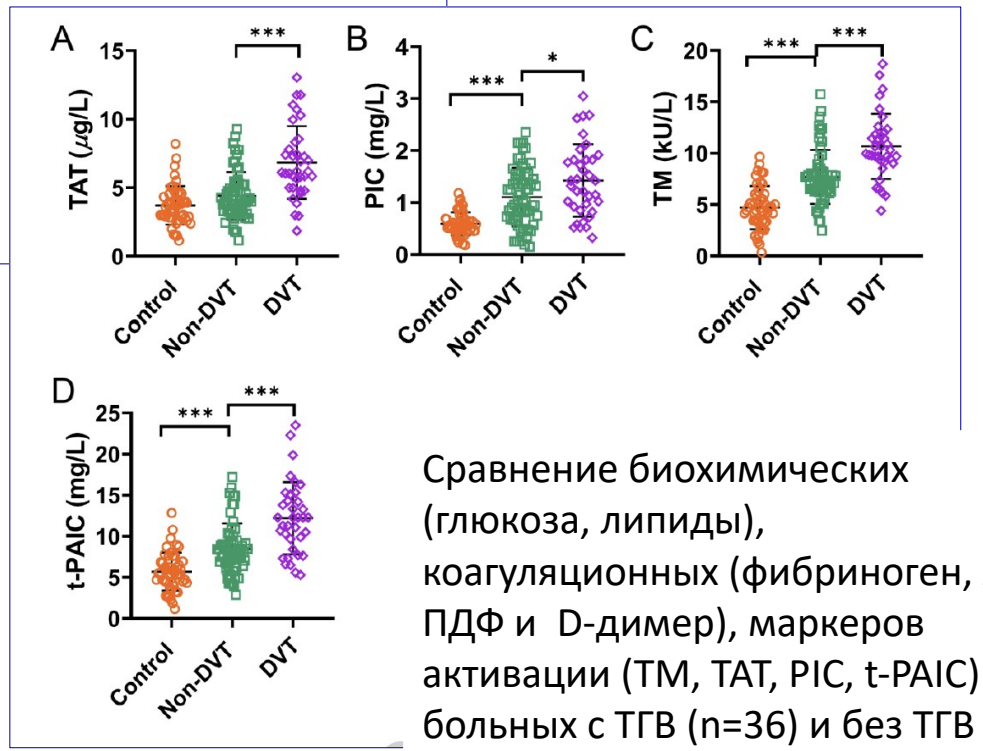
...rombomodulin, t-PA: PAI-1 complex



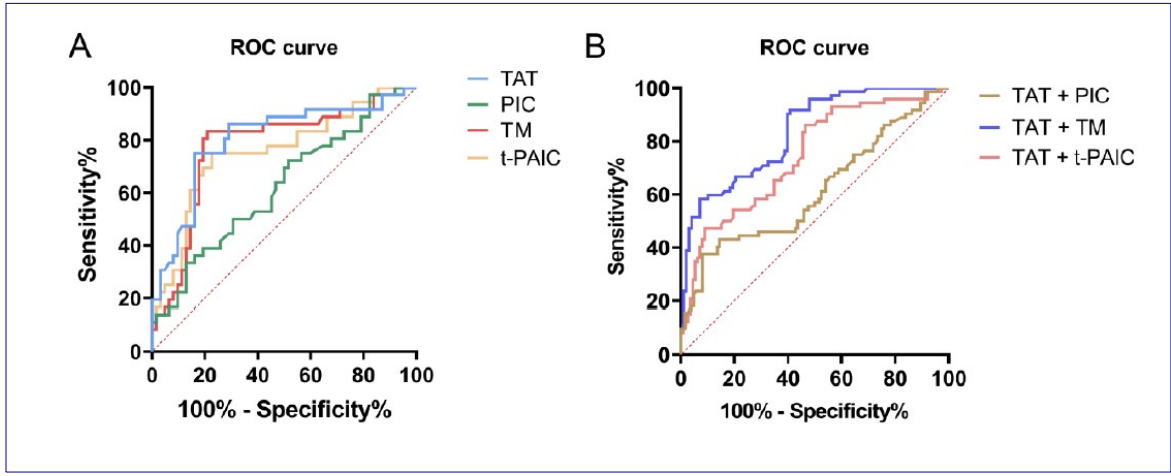
Стабильность в течение 7 дней хранения для TM, TAT, PAP и tPAI-C при 25, 4 и -25°C

Jiajun Huang MM., Jie Huang MM. , Chunli Sun MM., Feng Tian PhD., Jufang Wang PhD., Diagnostic value of Novel Thrombus Markers in COPD with Deep Venous Thrombosis, The American Journal of the Medical Sciences (2025), doi:https://doi.org/10.1016/j.amjms.2025.06.006





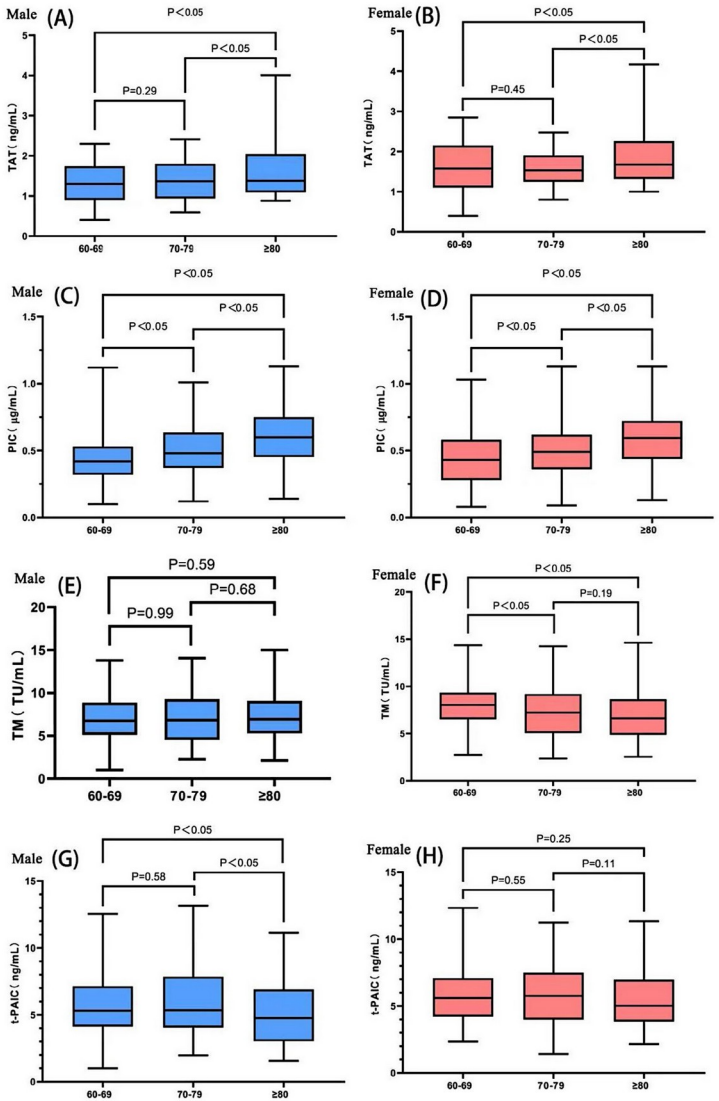
Сравнение биохимических (глюкоза, липиды), коагуляционных (фибриноген, АТ, ПДФ и D-димер), маркеров активации (TM, TAT, PIC, t-PAIC) у больных с ТГВ (n=36) и без ТГВ (n=62) и здоровых (n=50)



Диагностическое значение новых маркеров активации свертывания у пациентов с ТГВ и без ТГВ

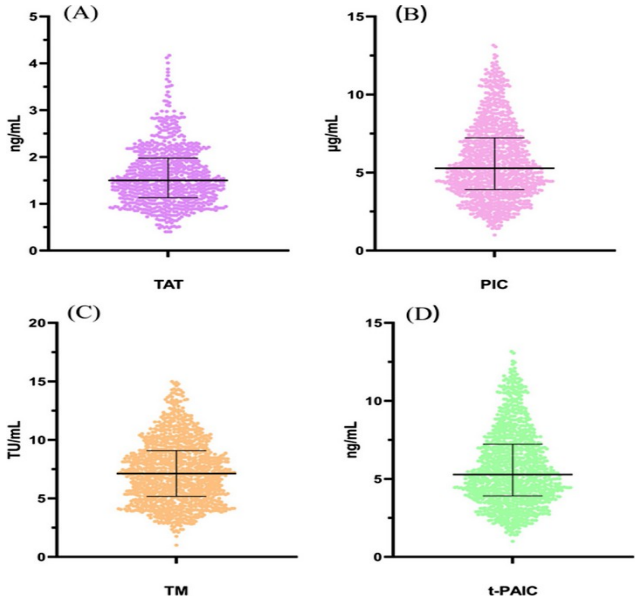
	AUC	95%CI	*P*	sensitivity	specificity
TAT	0.802	0.706 to 0.898	< 0.001	75.7%	55.9%
PIC	0.623	0.508~0.738	0.043	43.4%	42.2%
TM	0.776	0.674~0.877	< 0.001	51.6%	71.4%
t-PAIC	0.756	0.653~0.859	< 0.001	48.8%	57.8%
TAT + PIC	0.609	0.524~0.694	0.011	67.25%	38.74%
TAT + TM	0.833	0.774~0.892	< 0.001	87.5%	67.4%
TAT + t-PAIC	0.744	0.672~0.817	< 0.001	75.4%	61.46%

Одноцентровое исследование референтных интервалов для TAT, PIC, TM и t-PAIC у здоровых жителей Китая в пожилом возрасте



Распределение TAT, PIC, TM, и t-PAIC по возрасту и полу

Метод: Biotech Shine i2900 chemiluminescence immune assay
Концентрации в плазме: TAT, PIC, TM, и t-PAIC
1628 adults ≥ 60 years.
РИ представлены в виде 2.5th и 97.5th перцентилей



Общее распределение TAT, PIC, TM, и t-PAIC в группе

Zhang et al. Thrombosis Journal (2024) 22:82
https://doi.org/10.1186/s12959-024-00651-2
Thrombosis Journal

RESEARCH Open Access

A single-center study of reference intervals for TAT, PIC, TM and t-PAIC in healthy older Chinese adults

Lei Zhang[1], Yiming Chen[2], Rong Hu[3], Hua Chen[1], Xu Peng[1] and Hui Yuan[1*]

Abstract

Objective To explore the distribution of thrombin–antithrombin complex (TAT), plasmin-α2-antiplasmin inhibitor complex (PIC), thrombomodulin (TM), and tissue plasminogen activator-inhibitor complex (t-PAIC) in healthy older Chinese adults, and establish the reference intervals (RIs).

Methods The Biotech Shine i2900 chemiluminescence immune assay was used to measure the plasma concentrations of TAT, PIC, TM, and t-PAIC in 1628 adults ≥ 60 years. The RIs were established using the 2.5th and 97.5th percentiles of the distribution.

Results TAT levels were lower in males than females across all ages. Differences between the ages of 60–79 and ≥ 80 in both sex groups were statistically significant, with an upward trend with age. PIC levels showed no difference between the sexes but increased with age in both groups. TM levels did not differ between the sex groups, with slight fluctuation with age. The level in females aged 60–69 was slightly higher than that in the other groups; the difference was statistically significant. T-PAIC levels were not significantly different between the sex groups, with less fluctuation with sex and age. The level in males ≥ 80 years old was slightly lower than that in the other groups; the difference was statistically significant. The RIs for all markers in healthy older Chinese adults were determined and statistically reported by age and sex. For TAT, the RIs for males aged 60–79 and ≥ 80 are 0.51–2.30 ng/mL and 0.88–3.72 ng/mL, respectively, whereas for females aged 60–79 and ≥ 80, the RIs are 0.68–2.82 ng/mL and 1.02–3.67 ng/mL, respectively. For PIC, the RIs for the age groups 60–69, 70–79, and ≥ 80 are 0.10–0.89 μg/mL, 0.12–1.00 μg/mL, and 0.21–1.04 μg/mL, respectively. The RI of TM for females aged 60–69 is 3.32–13.22 TU/mL, whereas it is 2.96–13.26 TU/mL for the other groups. The RI of t-PAIC for males aged ≥ 80 is 1.63–10.68 ng/mL, whereas it is 2.33–11.34 ng/mL for the other groups.

Conclusions Discrepancies exist in thrombus markers among different sex and age groups. The RIs of TAT, PIC, TM and t-PAIC for healthy older Chinese adults were successfully established.

Keywords Thrombin–antithrombin complex, Plasmin-α2-antiplasmin inhibitor complex, Thrombomodulin, Tissue plasminogen activator-inhibitor complex, Aged, Reference interval

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[3]Health Examination Center, Beijing Anzhen Hospital, Capital Medical University, Beijing, China

Parameter	Sex	Age	N	RI	95%CI
TAT(ng/mL)	Male	60–79	553	0.51–2.30	0.37–2.37
		≥80	225	0.88–3.72	0.22–3.04
	Female	60–79	588	0.68–2.82	0.51–2.71
		≥80	262	1.02–3.67	0.49–3.23
PIC(μg/mL)	Total	60–69	590	0.10–0.89	0.04–0.82
		70–79	551	0.12-1.00	0.08–0.94
		≥80	487	0.21–1.04	0.19–1.01
TM(TU/mL)	Female	60–69	301	3.32–13.22	3.21–12.73
	Other groups		1327	2.96–13.26	1.85–12.43
t-PAIC(ng/mL)	Male	≥80	225	1.63–10.68	1.17–10.49
	Other groups		1403	2.33–11.34	0.32-10.00

TAT, PIC, TM, и t-PAIC в разных клинических ситуациях

Original Article

Page 1 of 8

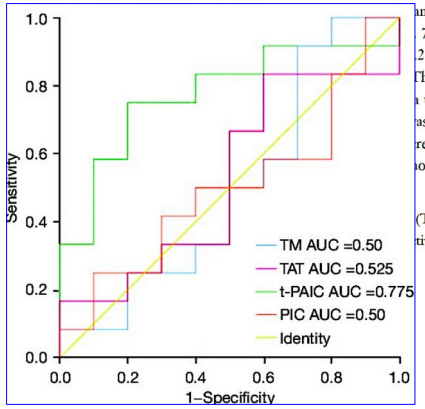
Thrombomodulin (TM), thrombin-antithrombin complex (TAT), plasmin-α2-plasmininhibitor complex (PIC), and tissue plasminogen activator-inhibitor complex (t-PAIC) assessment of fibrinolytic activity in postpartum hemorrhage: a comparative cohort study

Lele Wang, Junmin Zhong, Du Xiao, Wei Huang, Zheng Zheng, Yanmin Jian

Department of High-Risk Obstetrics, Guangzhou Women and Children's Medical Center, Guangzhou Medic

2022 Послеродовые кровотечения

Baokground: Detecting the changes of coagulation function in the early stage of pos
(PPH), which is the leading cause of maternal death, is the key to treatment this seri
there is less effective assessment methods. Thrombomodulin (TM), thrombin-antithro
plasmin-α2-plasmininhibitor complex (PIC), and tissue plasminogen activator-inhibit
are the new direct indicators for coagulation and fibrinolysis, and considered sensitiv
of the fibrinolytic system changing. The aim of this study was to investigate the cha
indicators in the early stage of PPH.
Methods: We retrospectively reviewed the new coagulate indicators, TM, TAT, PIC,
from PPH patients at Guangzhou Women and Children's Medical Center from Janua
According to the amount of blood loss, the patients were divided into 3 groups: Mi
<1,500 mL, n=17), Severe group (blood loss ≥1,500 mL, n=24); another 12 women wh
PPH were selected as the Normal group (n=12). The four indicators were measured
happened, or immediately when baby was born in the Normal group, and evaluated for th



T-PAIC может быть использован в качестве нового предиктора в раннем периоде тяжелого послеродового кровотечения, и в контроле за лечением.

Original Article

Diagnostic and Prognostic Value of TAT, PIC, TM, and t-PAIC in Malignant Tumor Patients With Venous Thrombosis

Clinical and Applied Thrombosis/Hemostasis
Volume 26: 1-10
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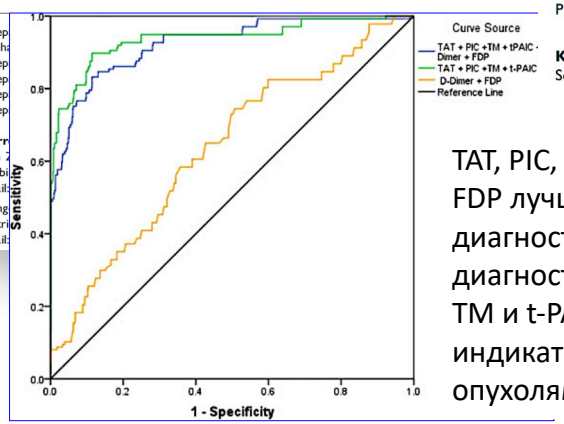
DOI: 10.1177/1076029620971041

Kun Zhou, MD[1], Jun Zhang, MD[2], Zun-Rong Zheng, MD[1], Yu-Zhen Zhou, MD[1], Xun Zhou, MD[1], Li-Da Wang, PhD[3], Bing Suo, PhD[3], Xiao-Feng Jiang, MD[4], Pei-Jia Liu, MD[5], and Dong-Hua Wang, MD[6]

2020 ВТЭО у онкобольных

...ication in pati
...minescence me
...dulin (TM), an
...duct (FDP) to
...with confirmed
whom had diagnosed VTE; 200 healthy individuals were classified as the control group
detected using Sysmex HISCL5000 automated analyzers, whereas FDP and D-dimer
coagulation analyzer. Receiver operating characteristic (ROC) curves were used to eva
probabilities were determined using Kaplan–Meier analysis, and multivariate analyses w
model. **Results:** Compared with healthy controls, patients with malignant tumors show
t-PAIC, D-dimer, and FDP. Similarly, compared with patients in the non-thrombosis group
significantly elevated levels of the above mentioned markers. Logistic regression analys
D-Dimer, and FDP were all associated with VTE. ROC analysis showed that "TAT+PIC
the highest sensitivity and specificity. Patients with elevated TAT, PIC, TM, and t-PAIC
tivariate Cox survival analysis showed that TM and t-PAIC were significantly associate
incidence of VTE was significantly lower in patients with malignant tumors who were trea
(LMWH), and their survival period was significantly longer than that of patients with malig
LMWH. **Conclusion:** TAT, PIC, TM, and t-PAIC combined with D-dimer and FDP wer
marker in the diagnosis of VTE in patients with malignant tumors. TAT and PIC can be use
VTE but not as prognostic markers. TM and t-PAIC might be independent prognostic indic
regardless of the state of thrombus.



TAT, PIC, TM и t-PAIC в сочетании с D-димером и FDP лучше, чем применение одного маркера в диагностике. TAT и PIC могут использоваться в диагностике ВТЭ
TM и t-PAIC – независимые прогностические индикаторы у пациентов со злокачественными опухолями, независимо от состояния тромба.

Original Manuscript

Clinical Efficacy of Soluble Thrombomodulin, Tissue Plasminogen Activator Inhibitor complex, Thrombin-Antithrombin complex,α2-Plasmininhibitor-Plasmin complex in Pediatric Sepsis

Clinical and Applied Thrombosis/Hemostasis
Volume 28: 1-9
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DOI: 10.1177/10760296221102929
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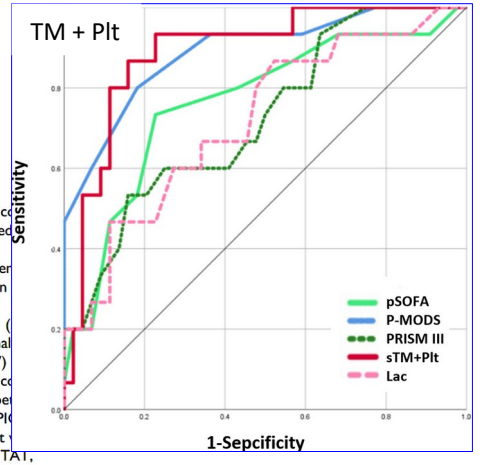
Juanzhen Li[1,*], Jingyi Zhou[2,*], Hong Ren[1], Teng Teng[1], Biru Li[1], Ying Wang[1], and Long Xiang[1,3]

2022 Педиатрический сепсис

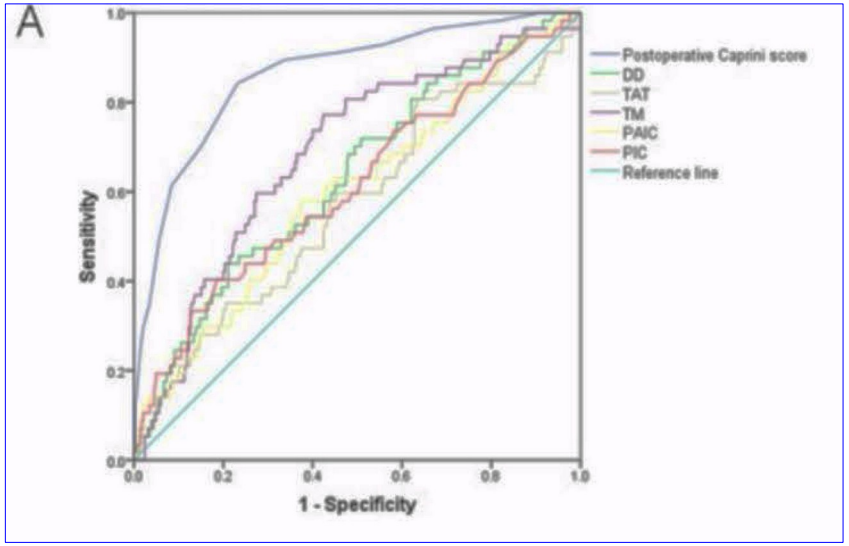
Abstract
...TM), tissue plasminogen activator inhibitor c
...in complex (PIC) in pediatric sepsis and pe
...e PICU of Shanghai Children's Medical Cer
...laboratory tests (CCTs) were evaluated on
day of sepsis diagnosis.
Results: Fifty-nine children were enrolled, There were significant differences in t-PAI-C (P = 0.001), Plt (P < 0.001), PT (
0.001), INR (P < 0.001), aPTT (P < 0.001), and TT (P = 0.048) between the pSIC and non-pSIC groups, logistic regression anal
showed that Plt (P = 0.032) was an independent risk factor for pSIC. Logistic regression analysis showed that sTM (P = 0.007)
Plt (P = 0.016) were independent risk factors for the outcome in pediatrics sepsis following discharge. The AUC of sTM c
bined with Plt on the mortality outcome of children with sepsis at discharge was 0.889 (95%CI: 0.781,0.956). which was be
than that for PRISM III (AUC, 0.723), pSOFA (AUC, 0.764), and blood Lac (AUC, 0.717) when sepsis was diagnosed in the PI
Conclusions: The t-PAI-C increased in children with pSIC. The prediction of sepsis outcome using sTM combined with Plt
better than with PRISM III, pSOFA, or Lac.Further research is still needed in the future to explore the clinical value of sTM, TAT,
PIC, and t-PAI-C in diagnosis and outcome of pediatrics sepsis and pSIC.

Keywords
Sepsis, Sepsis-induced coagulopathy, Novel coagulation markers, Endothelial cell injury, Children



Прогностическая способность на смертность после выписки:
sTM, TAT, PIC и t-PAIC + тесты КГ (AU-ROC 0,892),
pSOFA (AU-ROC 0,764);
коагулограмма (AU-ROC 0,740);
sTM, TAT, PIC и t-PAIC (AU-ROC 0,738);
PRISM III (AU-ROC 0,723);
и лактат (AU-ROC 0,717).

2025 Шкала Caprini и молекулярные маркеры прогноза ТГВ при переломах



ROC послеоперационного индекса Caprini и пяти тромботических биомаркеров (DD, TAT, TM, t-PAIC и PIC) в отдельности

Caprini score combined with thrombotic molecular markers for predicting DVT in patients with traumatic fractures

Zhengsheng Wu[1,3], Yaoqiang Du[1,3], Xiaofeng Cai[2] & Qian Xu[1]✉

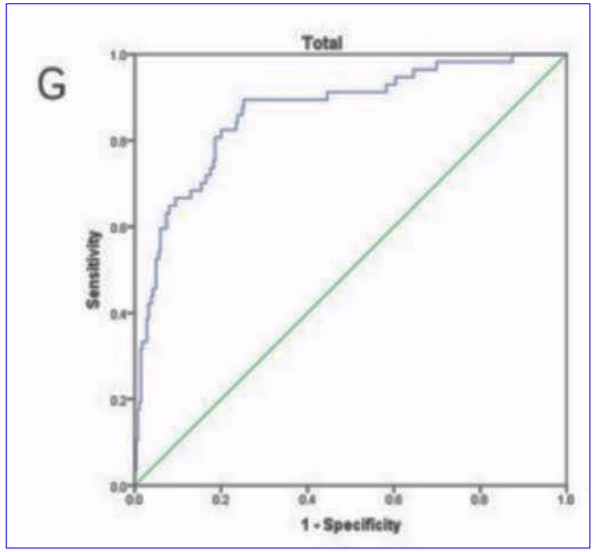
Deep vein thrombosis (DVT) is one of the important factors leading to death in patients undergoing fracture surgery. This study aims to investigating the predictive value of the Caprini score combined with thrombus molecular markers for the risk of DVT in patients after traumatic fracture surgery. A total of 342 patients who underwent surgery for traumatic fractures were included in the study. The patients were divided into two groups based on the occurrence of DVT after surgery: the DVT group ($n = 57$) and the non-DVT group ($n = 285$). A univariate analysis and logistic regression analysis were conducted on clinical factors and laboratory indicators that might be associated with DVT in patients with traumatic fractures. A predictive model for DVT risk was then constructed by combining thrombus molecular markers with the Caprini score. The median age of all patients was 65 years (54–75 years), the postoperative Caprini score was 9 (6–11), and the length of hospital stay was 11 days (8–16 days). In univariate analysis, age ($P = 0.029$), postoperative Caprini score ($P < 0.001$), and length of hospital stay ($P = 0.009$) were significantly associated with the occurrence of DVT. Logistic regression analysis showed that the risk of developing DVT increased with higher postoperative Caprini scores ($P < 0.001$), longer hospital stays ($P = 0.024$), and higher PIC levels ($P = 0.046$). Among these, the postoperative Caprini score was the most effective factor for diagnosing DVT, with an area under the curve (AUC) of 0.814 ($P < 0.001$) and a diagnostic cutoff of 11 points. The overall diagnostic efficacy of individual thrombus molecular markers from highest to lowest was TM, DD, PIC, t-PAIC, and TAT, with all except TAT showing statistical significance. The combined diagnostic efficacy of the postoperative Caprini score and PIC also showed statistical significance (AUC = 0.869, $P < 0.001$). Thrombus molecular markers combined with the postoperative Caprini score have potential predictive value for the risk of DVT in patients after traumatic fracture surgery.

Keywords Traumatic fracture, DVT, Thrombotic molecular markers, Caprini score

Venous thromboembolism (VTE) is one of the third most common cardiovascular diseases globally and one of the major factors contributing to postoperative mortality and unexpected in-hospital deaths in hospitalized patients[1], with an annual incidence of 1–2‰ in Europe and the United States, while the incidence in Asia and other regions is generally lower than 1‰. Fifty to sixty% of VTE cases are caused by surgery or hospitalization, and approximately 20% of VTE patients die within one year[2,3].VTE includes deep vein thrombosis (DVT) and pulmonary embolism (PE) with the former accounting for two-thirds[4].DVT refers to the pathological process where blood abnormally coagulates and obstructs the vein lumen in the deep veins of the lower limbs, commonly occurring in the lower extremities. Twenty-five to forty% of DVT patients experience varying degrees of functional impairment and reduced quality of life due to post-thrombotic syndrome (PTS) after thrombus formation. If the thrombus dislodges, pulmonary embolism (PE) can occur, which can lead to sudden death in severe cases. Therefore, DVT poses a significant burden on human health.

Traumatic fractures can impair limb function, affecting patients' daily lives and work, and surgical intervention is currently the primary clinical treatment for such fractures[5]. Despite the widespread use of

[1]Laboratory Medicine Center, Department of Transfusion Medicine, Zhejiang Provincial People's Hospital (Affiliated People's Hospital), Hangzhou Medical College, No.158 Shangtang Road, Hangzhou 310014, Zhejiang, China. [2]Center for Rehabilitation Medicine, Department of Neurology, Zhejiang Provincial People's Hospital (Affiliated People's Hospital), Hangzhou Medical College, Hangzhou, Zhejiang, China. [3]Zhengsheng Wu and Yaoqiang Du contributed equally to this work. ✉email: gotothepark@163.com



ROC послеоперационного индекса Caprini плюс пять тромботических биомаркеров в совокупности.

Старые знания + новые технологии = новые возможности в лабораторной практике

Snibe Diagnostic

CE 0123 REF

130218001M: 100 тестов
130618001M: 50 тестов
130718001M: 30 тестов

Набор реагентов in vitro для количественного определения комплекса тромбин-антитромбин III (MAGLUMI® TAT (CLIA)), методом иммунохемилюминесцентного анализа на автоматических анализаторах MAGLUMI®, в вариантах исполнения

НАЗНАЧЕНИЕ

TAT

ентов in vitro для ко
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Snibe Diagnostic

CE 0123 REF

130218002M: 100 тестов
130618002M: 50 тестов
130718002M: 30 тестов

Набор реагентов in vitro для количественного определения тромбомодулина (MAGLUMI® TM (CLIA)), методом иммунохемилюминесцентного анализа на автоматических анализаторах MAGLUMI®, в вариантах исполнения

НАЗНАЧЕНИЕ

TM

ентов in vitro для количественного
х MAGLUMI®. Результаты исслед
, в комбинации с другими клинически

Snibe Diagnostic

CE 0123 REF

130218003M: 100 тестов
130618003M: 50 тестов
130718003M: 30 тестов

Набор реагентов in vitro для количественного определения комплекса α2-ингибитор плазмина-плазмина (MAGLUMI® PIC (CLIA)), методом иммунохемилюминесцентного анализа на автоматических анализаторах MAGLUMI®, в вариантах исполнения

НАЗНАЧЕНИЕ

PIC

азме человека на анализатор
ки фибринолитических за
лабораторными данными.

Snibe Diagnostic

CE 0123 REF

130218004M:100 тестов
130618004M: 50 тестов
130718004M: 30 тестов

Набор реагентов in vitro для количественного определения комплекса тканевого активатора плазминогена-ингибитор активатора плазминогена (MAGLUMI® tPAIC (CLIA)), методом иммунохемилюминесцентного анализа на автоматических анализаторах MAGLUMI®, в вариантах исполнения

НАЗНАЧЕНИЕ

tPAIC

in vitro для количественного определения комплекса тканевого активатора
ибитор активатора плазминогена в плазме крови человека на анализаторах MAGLUMI®.
ования предназначены для оценки состояния фибринолитической системы и диагностики
ых заболеваний в комбинации с другими клиническими и лабораторными данными.

D-димер
Фибриноген
vWF
Фактор VIII
ПДФ
ТЭГ

+

TAT, TM, PIC, tPAIC

- ✓ Тромбин-антитромбиновый комплекс,
- ✓ Тромбомодулин
- ✓ α2-ингибитор плазмина/плазмин комплекс
- ✓ Тканевой активатор плазмииногена/ингибитор активатора плазминогена комплекс

БЛАГОДАРЮ ЗА ВНИМАНИЕ !

НАЗАР АУДАРҒАНЫҢЫЗҒА РАҚМЕТ!