Acil Koagülasyon Testleri ve Preanalitik Hata Kaynakları

Çiğdem Sönmez
SBÜ Dr. Abdurrahman Yurtarslan Ankara Onkoloji EAH
Tıbbi Biyokimya

Acil Hemostaz

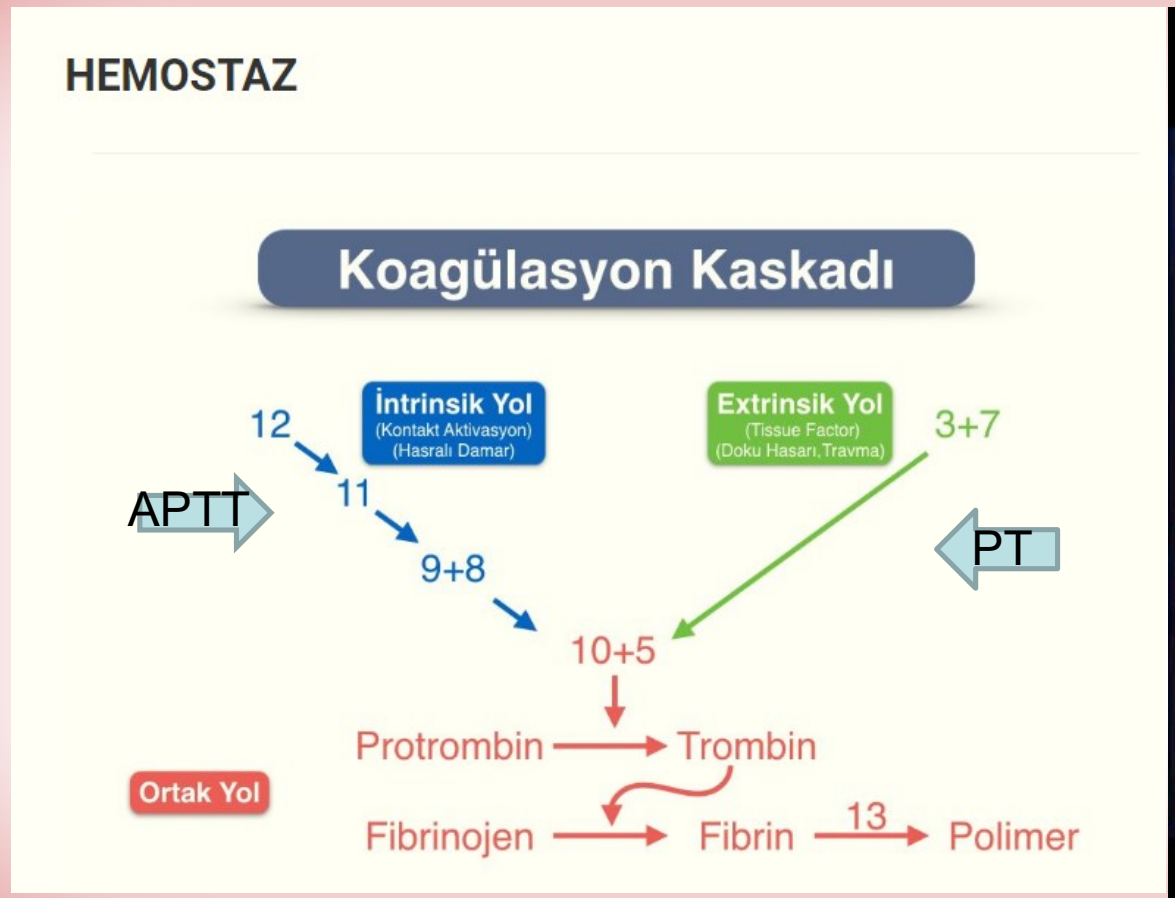
- Acil servislerde hemostazın değerlendirilmesi
  - Travma
  - Kanama
  - DİK (Dissemine intravasküler koagülasyon)

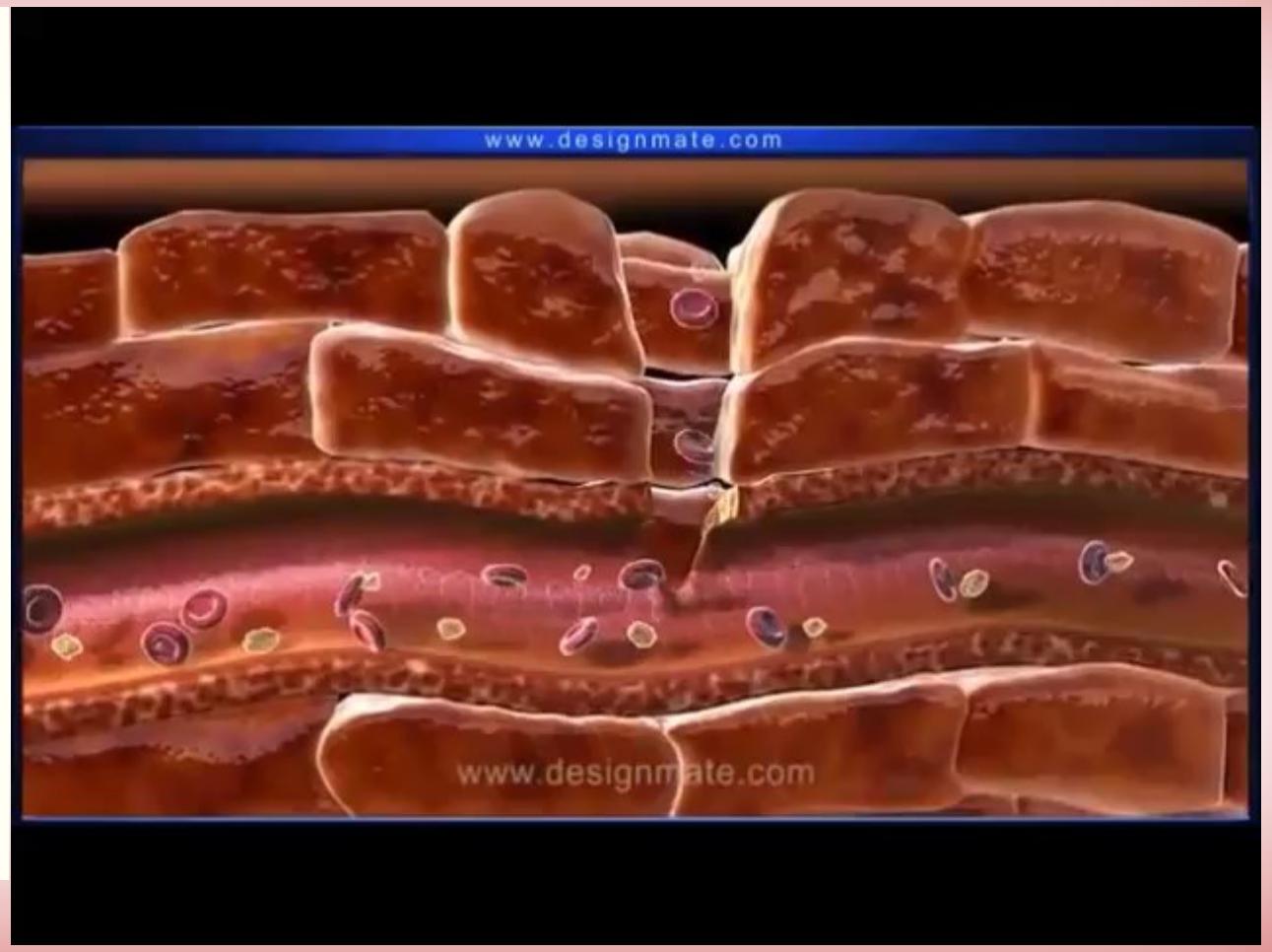
- Hangi kan ürününe ihtiyaç duyulduğu
- İlaç düzeyi takibi
- Tedavi planlama
- TAT kısa olmalıdır.
- Klinik karara destek olabilecek, yeterli doğruluk

Pato fizyolojik sınıflandırma
SICK FAIL

- S= Spuriorus Preanalytical = Sample or patient Issusue
- I= Inhibitörler
- C= konjenital heredeiter faktör eksiklikleri
- K= Vitamin K eksikliği
- F= Faktör eksiklikleri kazanılmış tek veya çoklu
- A= Antikoagulan
- I= ICF (Intravasculer koagülasyon ve fibrinolizis veya DIC
- L= Liver hastalığı

Hemostaz


HEMOSTAZ
Koagülasyon Kaskadı
İntrinsik Yol
(Kontakt Aktivasyon)
(Hasralı Damar)
Extrinsik Yol
(Tissue Factor)
(Doku Hasarı,Travma)
12
11
9+8
3+7
APTT
PT
10+5
Protrombin
Trombin
Ortak Yol
Fibrinojen
Fibrin
13
Polimer

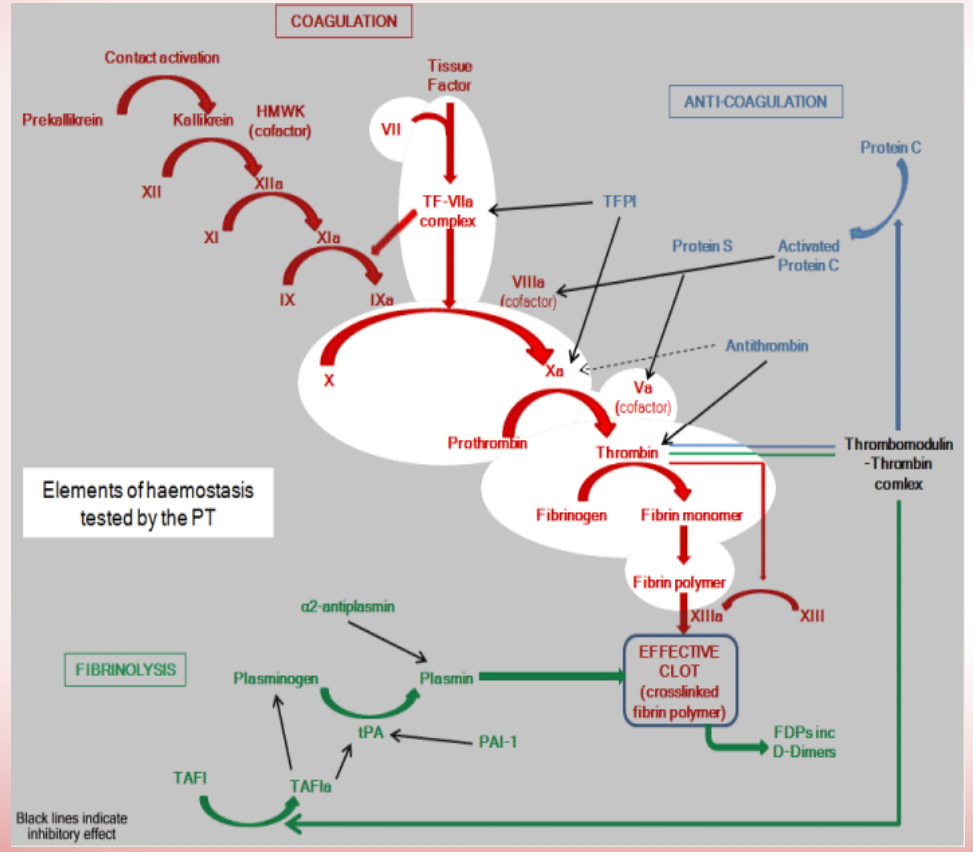

www.designmate.com
www.designmate.com

Hemostazın hızlı değerlendirilmesinde

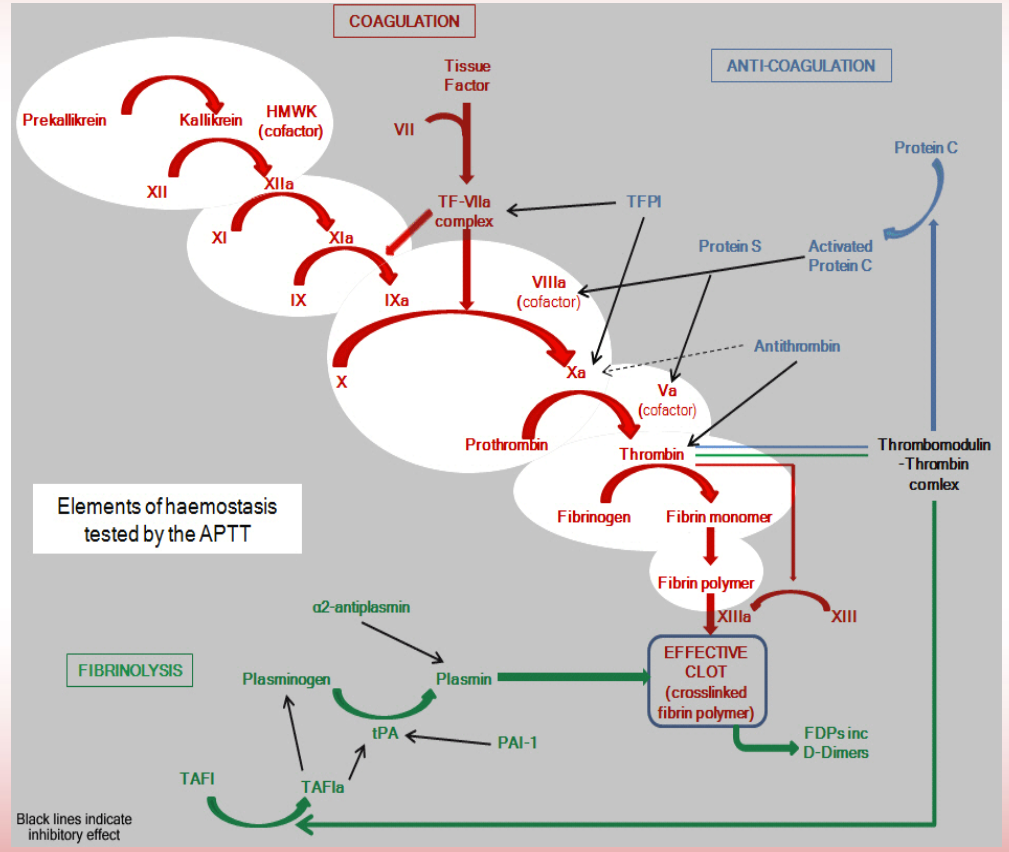
- Standart koagülasyon testleri kullanılır;
  - PT
  - aPTT
  - Fibrinojen
  - Trombosit sayımı
  - D-dimer
  - Anti Faktör Xa

- Bu ölçümler hangi tedavi protokollerinin uygulanacağı konusunda bilgi sağlar:
  - PT, aPTT; taze donmuş plazma veya konsantre faktörler
  - Fibrinojen; kriyopresipitat veya konsantre fibrinojen
  - Trombosit sayımı; trombosit transfüzyonu gibi
- Ayrıca ilaç warfarin UFH ve LMWH tedavilerinin takibinde kullanılır.

PT


COAGULATION
Contact activation
Prekallikrein
Kallikrein
HMWK (cofactor)
XII
XIIa
XI
XIa
IX
IXa
Tissue Factor
VII
TF-VIIa complex
TFPI
ANTI-COAGULATION
Protein C
Protein S
Activated Protein C
VIIIa (cofactor)
X
Xa
Va (cofactor)
Antithrombin
Prothrombin
Thrombin
Thrombomodulin -Thrombin comlex
Fibrinogen
Fibrin monomer
Fibrin polymer
XIIIa
XIII
Elements of haemostasis tested by the PT
α2-antiplasmin
FIBRINOLYSIS
Plasminogen
Plasmin
tPA
PAI-1
EFFECTIVE CLOT (crosslinked fibrin polymer)
FDPs inc D-Dimers
TAFI
TAFIa
Black lines indicate inhibitory effect

APTT


COAGULATION
Prekallikrein
Kallikrein
HMWK (cofactor)
XII
XIIa
XI
XIa
IX
IXa
Tissue Factor
VII
TF-VIIa complex
TFPI
ANTI-COAGULATION
Protein C
Protein S
Activated Protein C
VIIIa (cofactor)
X
Xa
Va (cofactor)
Antithrombin
Prothrombin
Thrombin
Thrombomodulin -Thrombin comlex
Fibrinogen
Fibrin monomer
Fibrin polymer
XIIIa
XIII
Elements of haemostasis tested by the APTT
α2-antiplasmin
FIBRINOLYSIS
Plasminogen
Plasmin
tPA
PAI-1
EFFECTIVE CLOT (crosslinked fibrin polymer)
FDPs inc D-Dimers
TAFI
TAFIa
Black lines indicate inhibitory effect

Heparin / Warfarin

İlaç	Etki	Mekanizma	Takip	Etki
Heparin	Trombin inhibisyonu	AT cofaktor	aPTT AcT	Hemen
Warfarin	Faktörlerini sentzinin azltır.	Vitamin K	PT	Daha geç 3-5 gün

Acil Koagulasyon tesleri

- Fibrinojen
- D-Dimer
- Anti Faktör Xa

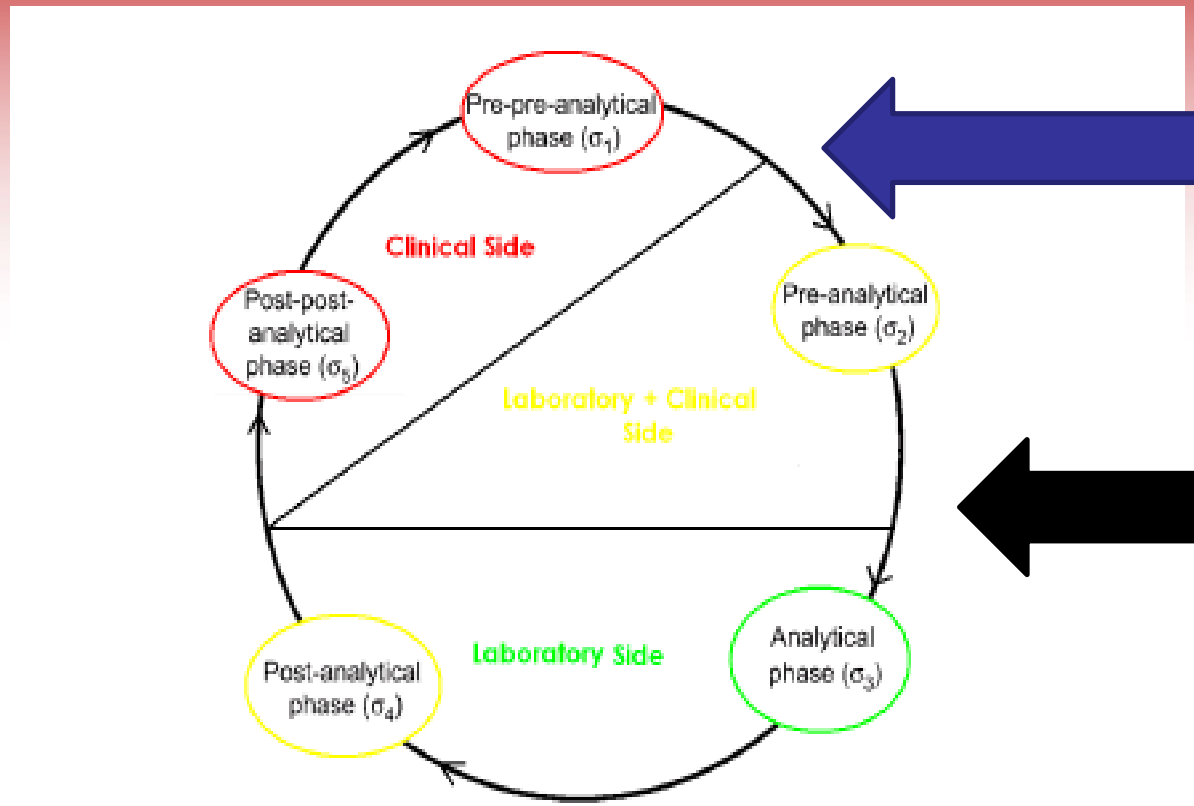


Fig. 2. Total testing process in modern clinical laboratories.

Laboratuvar
Klinisyen

Laboratuvar dışı
Numune alımı
Ekipman
Flebotomist
Hasta kaynaklı
Transfer
Laboratuvar içi

Six Sigma as a Quality Management Tool: Evaluation of Performance in Laboratory Medicine
By Abdurrahman Coskun, Ibrahim Unsal, Mustafa Serteser and Tamer Inal
DOI: 10.5772/9928

Hata Kaynakları

- Pre-preanalitik dönem
  - Akılcı test istemi ve algoritması
- Preanalitik dönem
  - Hasta kaynaklı
  - Kan alma teknisyeni ve kan alma ekipmanları kaynaklı
  - Transfer
  - Laboratuvar analiz öncesi dönem

Acil Serviste Koagülopatinin Tanısı

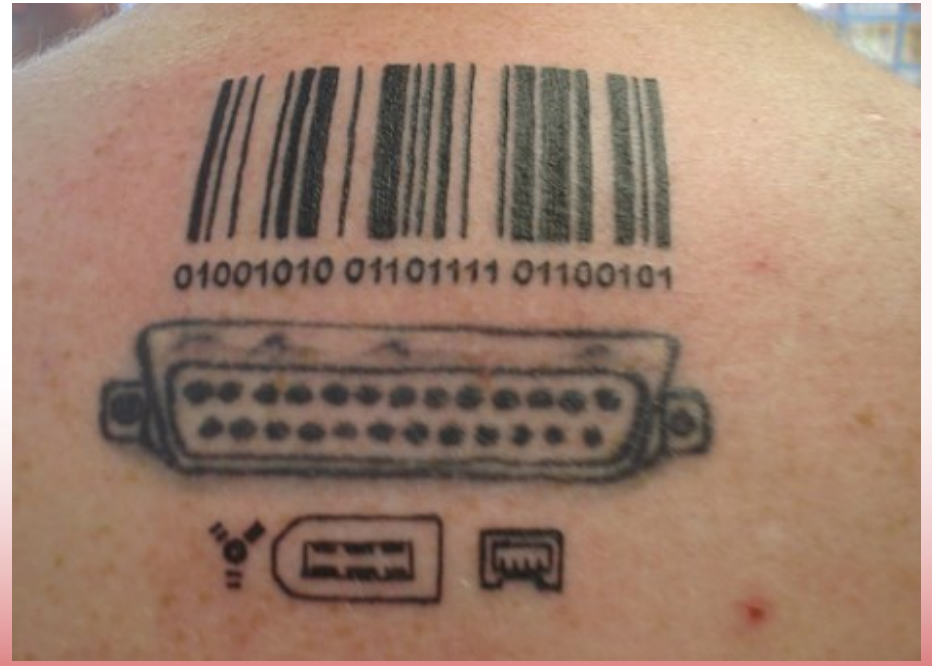
- Anamnez
- Laboratuvar değerlendirmesi için kısa bilgilendirme

✓ **KOAGÜLASYON TESTL**

✓ **NUMUNE ALMA**

Örnek Etiketlenmesi

- Örnek etiketlemesi hastanın yanında iken yapılmalıdır.
- Barkot etiketinde hastanı adı / kimlik numarası .vb.
- Tarih ve kan alma zamanı
- Örnek türü
- Kan alan kişinin adı
- İstenilen tetkikler



Örnek Alınması

- Kapalı kan alma sistemleri
- İğne
- Enjektör ile kan alma
- Damar yolundan kan alma
- Kelebek set ile kan alma
- Kataterden kan alma

Örnek Alınması

- İğne kalınlığı 19-22 G genellikle optimum kalınlık
- Kelebek set alımında dikkat edilecek hususlar
- Kataterden kan alınır iken dikkat edilecek hususlar

Örnek Alınması

- Ön hazırlık
- Turnike
- 3dk.sonrasında
- PT %3.1 kısalır
- Fibrinojen% 10,1
- D-dimer %13,4 a

VENÖZ KAN ALMA
(FİLEBOTOMİ)
KILAVUZU

Örnek tüpleri Sıralaması

- Diskart tüp (artık kullanılmıyor)
- Kan Alma esnasında tüp sıralaması
- Tüpün yapısı
- Tüpün kan alınması sonrası çalkalanması

Değişken (1)	Kan kültürü/Besiyeri	Besiyeri ile kan karışımını sağlamak için hafifçe altüst edilir
(2)	Katkısız cam veya plastik serum tüpü	Gerek yok
(3)	Koagülasyon tüpü/Sitratlı	3-4 kez
(4)	ESR tüpü/Sitratlı	3-4 kez
(5)	Serum tüpü/ Jelsiz	5 kez
(5)	Serum tüpü/Jelli	5 kez
(5)		5 kez
(5)	Serum tüpü/Trombin pıhtı aktivatörlü tüp	5 kez
(6)	Plazma tüpü/Jelli veya jelsiz heparinli tüp	8-10 kez
(7)	Plazma tüpü/Jelli veya jelsiz EDTA'lı tüp	8-10 kez
(8)	Plazma tüpü/ Florür/potasyum oksalat;Florür/EDTA Florür/heparin	8-10 kez

VENÖZ KAN ALMA
(FİLEBOTOMİ)
KILAVUZU

Quality Standards for Sample Collection in Coagulation Testing

Giuseppe Lippi, M.D.[1] Gian Luca Salvagno, M.D.[2] Martina Montagnana, M.D.[2]
Gabriel Lima-Oliveira, M.D.[2] Gian Cesare Guidi, M.D.[2]
Emmanuel J. Favaloro, Ph.D., M.A.I.M.S., F.F.Sc. (RCPA)[3]

[1] Department of Pathology and Laboratory Medicine, Laboratory of Clinical Chemistry and Hematology, Academic Hospital of Parma, Parma, Italy
[2] Department of Life and Reproductive Sciences, Section of Clinical Biochemistry, University of Verona, Verona, Italy
[3] Department of Haematology, Institute of Clinical Pathology and Medical Research (ICPMR), Westmead Hospital, New South Wales, Australia

Address for correspondence and reprint requests Giuseppe Lippi, M.D., U.O. Diagnostica Ematochimica, Azienda Ospedaliero-Universitaria di Parma, Via Gramsci, 14, 43126 - Parma, Italy (e-mail: glippi@ao.pr.it, ulippi@tin.it).

Semin Thromb Hemost 2012;38:565–575.

VENÖZ KAN ALMA
(FİLEBOTOMİ)
KILAVUZU

January 2008

H21-A5

Collection, Transport, and Processing of Blood Specimens for Testing Plasma-Based Coagulation Assays and Molecular Hemostasis Assays; Approved Guideline—Fifth Edition

CE Update [coagulation and hematology | phlebotomy]

Preanalytical Variables in the Coagulation Laboratory

Jeffry B. Lawrence, MD
Medical and Scientific Affairs, BD Clinical Laboratory Solutions, Franklin Lakes, NJ

DOI: 10.1309/ER9P64EBMCFR47KY

After reading this article, the reader should understand how errors occur in the preanalytical phase of testing, and how efforts can be made to correct these errors.
Hematology exam 0301 questions and the corresponding answer form are located after the "Your Lab Focus" section on p. 69.

- Errors in coagulation laboratory results, whether in assays performed for anticoagulant monitoring or for screening and diagnostic testing for hemorrhagic and thrombotic disorders, can lead to clinical mismanagement and significant risk for the patient.
- The majority of coagulation laboratory errors arise in the preanalytical phase; therefore, ensuring the quality of citrated blood samples is critical for

of heart attack and stroke by making the blood less clottable, this same effect increases the patient's risk of hemorrhage. This necessitates laboratory monitoring of the patient's response to these drugs on an ongoing basis. For instance, of the approximately 300 million coagulation tests performed annually in the United States, more than 40 million are prothrombin times (PT) performed for monitoring of warfarin therapy.

While monitoring of anticoagulant

sample for the accuracy and precision of patient test results, and discuss approaches to improve coagulation laboratory performance by controlling preanalytical variability.

Laboratory Errors and Role of Preanalytical Variables

Just as with all other laboratory testing, in the coagulation laboratory the ultimate goal is to reflect the patient's actual state of hemostatic function in vivo.

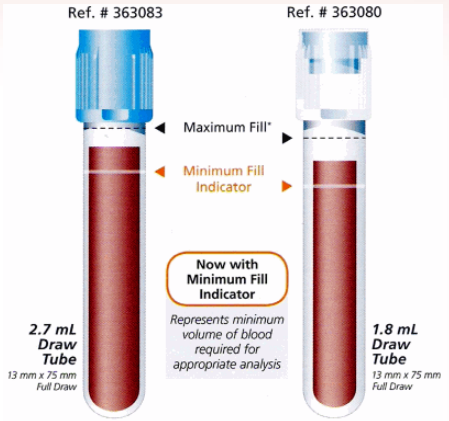
Örnek Tipleri Karıştırılması/

Örnek kesinlikle çalkalanmamalıdır.

5-6 kez alt üst edilmelidir.

Örnek Tüpleri

- Dolum Miktarı
- Dilüsyon oranı
- Son kullanma tarihi
- Farklı tüpler birbirleri ile karıştırılmaz
- Tüpün vakum gücü önemlidir.
- Son kullanma tarihleri yakından takip edilmelidir.



Antikoagülan

- % 3.2 Na–Sitrat (0,109M)

~~EDTA~~

- % 3,8 Na-Sitrat (0,129M)

~~Heparin~~

- Sitrat teofilin adenozin dipirimadol (CTAD)
- UFH tedavisi takibinde süre 4saate uzayabilir
- Işıktan korunmalı ve soğukta saklanmalıdır.

Na – Sitrat Konsantarsyonu

The Effect of 3.2% and 3.8% Sodium Citrate on Specialized Coagulation Tests

Franz Ratzinger, MD; Mona Lang; Sabine Belik; Klaus G. Schmetterer, MD, PhD; Helmuth Haslacher, MD; Thomas Perkmann, MD; Peter Quehenberger, MD

• *Context.*—Coagulation testing is challenging and depends on preanalytic factors, including the citrate buffer concentration used.

Objective.—To better estimate preanalytic effects of the citrate buffer concentration in use, the difference between results obtained by samples with 3.2% and 3.8% citrate was evaluated.

Design.—In a prospective observational study with 76 volunteers, differences related to the citrate concentration were evaluated. For both buffer concentrations, reference range intervals were established according to the recommendations of the C28-A3 guideline published by the Clinical and Laboratory Standards Institute.

Results.—In our reagent-analyzer settings, most parameters evaluated presented good comparability between citrated samples taken with 3.2% and 3.8% trisodium buffer. The ellagic acid containing activated partial thromboplastin time reagent (aPTT-FS) indicated a systemic and proportional difference between both buffer concentrations, leading to an alteration in its reference ranges. Further, a confirmation test for lupus anticoagulant assessment (Staclot LA) showed only a moderate correlation ($r_p = 0.511$) with a proportional deviation between both citrate concentrations. Further, a statistically significant difference was found in the diluted Russell viper venom time confirmation testing, coagulation factors V and VIII, and the protein C activity, which was found to be of minor clinical relevance.

Conclusions.—With caution regarding the potential impact of the reagent-analyzer combination, our findings demonstrate the comparability of data assessed with 3.2% and 3.8% buffered citrated plasma. As an exception, the aPTT-FS and the Staclot LA assay were considerably affected by the citrate concentration used. Further studies are required to confirm our finding using different reagent-analyzer combinations.

(*Arch Pathol Lab Med.* 2018;142:992–997; doi: 10.5858/arpa.2017-0200-OA)

Ratzinger F, Lang M, Belik S, Schmetterer KG, Haslacher H, Perkmann T, Quehenberger P. The Effect of 3.2% and 3.8% Sodium Citrate on Specialized Coagulation Tests. Arch Pathol Lab Med. 2018 Aug;142(8):992-997. doi: 10.5858/arpa.2017-0200-OA.

Na-Sitrat %3.2 Na-Sitrat %3.8

- Çalışma %3.2 ve %3.8 Na-sitratlı tüplere
- 76 sağlıklı birey
- 2500 g 15 dk 15C de santrifüj
- Sonuçta sadece APTT testlerinde fark izlenirken diğer parametrelerde anlamlı bir fark gözlenmedi.
- Verilerin karşılaştırılabilirliğini göstermektedir

Ratzinger F, Lang M, Belik S, Schmetterer KG, Haslacher H, Perkmann T, Quehenberger P. The Effect of 3.2% and 3.8% Sodium Citrate on Specialized Coagulation Tests. Arch Pathol Lab Med. 2018 Aug;142(8):992-997. doi: 10.5858/arpa.2017-0200-OA.

Örnek Tüpleri Cam Plastik

A comparison of glass and plastic blood collection tubes for routine and specialized coagulation assays: a comprehensive study.

Kratz A[1], Stanganelli N, Van Cott EM.

⊕ **Author information**

Abstract

CONTEXT: Blood collection tubes made from plastic are beginning to replace glass tubes. Coagulation test results can be influenced easily by preanalytic factors, including exposure to surfaces that activate the clotting cascade.

OBJECTIVE: To compare the effects of the blood collection tube material on 22 coagulation assays performed in clinical laboratories.

DESIGN: Paired blood samples from 28 healthy volunteers were drawn into BD Vacutainer Glass Citrate Tubes and BD Vacutainer Plus Plastic Citrate Tubes, and the results of coagulation assays were determined in parallel.

RESULTS: No statistically significant differences were observed between glass and plastic for 14 assays: prothrombin time (and international normalized ratio); activated partial thromboplastin time; activated protein C resistance; antithrombin activity; factors II, V, VIII, and IX; alpha2-antiplasmin; plasminogen activity; von Willebrand factor antigen; ristocetin cofactor; thrombin time; and reptilase time. Statistically significant differences were found for fibrinogen; chromogenic protein C activity; protein S activity; PTT-LA lupus anticoagulant-sensitive activated partial thromboplastin time; and factors VII, X, XI, and XII. Mean differences ranged from 0.4% to 5.5% and were unlikely to be of clinical significance.

CONCLUSIONS: The results of this study suggest that plastic tubes can be used in place of glass tubes for a wide variety of coagulation assays.

Kratz A, Stanganelli N, Van Cott EM. A comparison of glass and plastic blood collection tubes for routine and specialized coagulation assays: a comprehensive study. Arch Pathol Lab Med. 2006 Jan;130(1):39-44.

Örnek Tüpleri Cam Plastik

Int J Lab Hematol. 2011 Apr;33(2):219-25. doi: 10.1111/j.1751-553X.2010.01271.x. Epub 2010 Oct 27.

Comparison between siliconized evacuated glass and plastic blood collection tubes for prothrombin time and activated partial thromboplastin time assay in normal patients, patients on oral anticoagulant therapy and patients with unfractioned heparin therapy.

D'Angelo G[1], Villa C.

⊕ Author information

Abstract

INTRODUCTION: The study was designed to evaluate whether there was a statistically significant effect between evacuated glass tubes and plastic tubes on prothrombin time (PT) and activated partial thromboplastin time (aPTT).

METHODS: Blood samples were drawn into four different tubes from three patient populations-apparently healthy patients, patients on oral anticoagulant therapy with vitamin K antagonists (OAT-vka) and patients being treated with unfractioned heparin (UFH). Testing was performed on an automated coagulation analyzer, and statistical analysis was achieved using a test of variance (anova).

RESULTS: For normal patients, there were no statistically significant differences for the aPTT test; however, there were statistically significant differences for the PT test. For patients on OAT-vka, statistically significant differences were clearly observed between the four tube types for the PT test. For patients treated with UFH, there were no statistically significant differences for the aPTT test.

CONCLUSION: The data showed a statistically significant difference between glass and plastic tubes in the normal population only for the PT test, with consequent repercussions for patients on OAT. This means that appropriate care and validation should take place whenever there is a change in tube type.

D'Angelo G, Villa C. Comparison between siliconized evacuated glass and plastic blood collection tubes for prothrombin time and activated partial thromboplastin time assay in normal patients, patients on oral anticoagulant therapy and patients with unfractioned heparin therapy. Int J Lab Hematol. 2011 Apr;33(2):219-25. doi: 10.1111/j.1751-553X.2010.01271.x.

Örnek Tüpleri Plastik

A new plastic collection tube made of polyethylene terephtalate is suitable for monitoring traditional anticoagulant therapy (oral anticoagulant, unfractionated heparin, and low molecular weight heparin).

Toulon P[1], Ajzenberg N, Smahi M, Guillin MC.

⊕ Author information

Abstract

To improve the safety of blood collection, plastic tubes have been developed but various interactions with the coagulation system and/or antithrombotic drugs were reported with the first generation of such tubes. The aim of this multicentre study was to compare hemostasis test results measured in evacuated plastic tubes made of polyethylene terephtalate (VenoSafe, Terumo Europe) and in siliconized glass tubes containing the same citrate concentration (0.129 M). In addition, the impact of aging of the plastic tube was investigated by collecting blood samples in tubes at 8 months and at 1 month before expiry. Blood was drawn in 3 centres from untreated patients (n=269), patients on oral anticoagulant treatment (OAT, n=221), and patients treated with either unfractionated heparin (UFH, n=73) or a low molecular weight derivative (LMWH, n=48). Prothrombin time (PT) or INR, activated partial thromboplastin time (APTT) and anti-FXa activity were locally performed, when applicable. In untreated patients and in patients on OAT, PT and APTT values were found statistically shorter ($p<0.05$) when evaluated in plastic tubes than in glass tubes, except when PT was evaluated using a human thromboplastin. Surprisingly, significantly longer APTT and higher anti-FXa activities were obtained when blood from patients on UFH was drawn in plastic than in glass tubes. However, none of the differences had any clinical relevance (Bland-Altman analysis). In patients on anticoagulant treatment, there was no effect of aging of the plastic tubes. These results suggest that the plastic tube VenoSafe is suitable for coagulation testing both in untreated subjects and more interestingly in patients on traditional anticoagulant therapy during the whole shelf life indicated by the manufacturer.

Toulon P, Ajzenberg N, Smahi M, Guillin MC. A new plastic collection tube made of polyethylene terephtalate is suitable for monitoring traditional anticoagulant therapy (oral anticoagulant, unfractionated heparin, and low molecular weight heparin). Thromb Res. 2007;119(2):135-43.

Transport

- Regulations
  - IATA International Air Transport Association
  - DOT Department of Transportation
  - CDC
- Konvansiyonel yolla taşıma
- Pnömatik sistem ile taşıma

PTS ‘nin Laboratuvar Parametrelerine Etkisi

Pneumatic tube system transport does not alter platelet function in optical and whole blood aggregometry, prothrombin time, activated partial thromboplastin time, platelet count and fibrinogen in patients on anti-platelet drug therapy

49 yoğun bakım hastası 13 kadın 36 erkek hasta yaş aralığı 47-89

- PTS : 500m ve 4m/sn 2 dk.
- Hastalarda klopidgral ve asetil salisilt asit tedavisi
- dual anti platelet tedavi altında
- koagülasyon parametereleri anlamlı fark bulunmamıştır.
- istatistiksel olarak anlamlı fark bulunamamıştır.

Enko D, Mangge H, Münch A, Niedrist T, Mahla E, Metzler H, Prüller F.
Pneumatic tube system transport does not alter platelet function in optical and whole blood aggregometry, prothrombin time, activated partial thromboplastin time, platelet count and fibrinogen in patients on anti-platelet drug therapy.
Biochem Med (Zagreb). 2017 Feb 15;27(1):217-224.

Transport

- Sitratlı kan örnekleri
- 1 saat
- Oda ısısında
- Kapak kapalı olarak
- Dik bir pozisyonda transfer edilmelidir.
- Fiziksel travmadan korunmalıdır.
- Buzdolabı buz buzlu su banyosu önerilmez

- Transport edilirken
- Sitratlı tam kan / Santrifüj edilmiş sitratlı plazma/ Santrifüj sonrası plazması ayrılmış olarak transfer edilebilir.
- Seçilecek yöntem mesafe süre ve teste göre belirlenmelidir.
- Prosedür ve talimatlar bu doğrultuda hazırlanmalı uygulanmalıdır.

Transport

TEST	CLSI H21 A5	Diğer
APTT	4 saat	18-24 saat
APTT veya anti Faktör Xa (UFH)	1 saat	
APTT veya anti Faktör Xa (LMWH)	4 saat	24 saat
PT	4 saat	24 saat
Fibrinojen	4 saat	48 saat 7 gün
D-Dimer	4 saat	48 saat

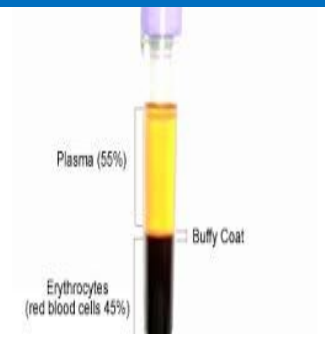
Adcock Funk DM, Lippi G, Favaloro EJ. Quality standards for sample processing, transportation, and storage in hemostasis testing. Semin Thromb Hemost. 2012 Sep;38(6):576-85. doi: 10.1055/s-0032-1319768

Transport pH

- pH
- Trisodyum sitrat sayesinde örnek pH 7.30-7.45 arasındadır.
- Eğer tüpün kapağı açık bırakılırsa 30 dk içinde ortamdaki CO2 plasmaya difüze olur.
- Plasması ayrılmış numuneler bu duruma tam kan halindeki numunelere göre daha fazla maruz kalırlar çünkü tam kanda hemoglobinin tamponlayıcı kapasitesi bulunur.
- pH değişmesi PT ve APTT testinin uzamasına neden olur
- pH değerinde 0,8'lik bir değişim APTT testinde kullanılan reaktifin tamponlama özelliğine bağlı olarak 20 sn'ye kadar uzamaya neden olabilir.

Örnek Hızırlama Santirifüj

- 1500 g 15 dk
- PPP
- Acil koagülasyon testleri trombosit sayısı <200x109 değerine kadar etkilenmemektedir.
- Eğer ilk 10 dk içinde analiz yapılacak ise süre azaltılabilir hız arttırılabilir.
- Eğer soğutmalı santrifüj kullanılacak ise normal ısı tercih edilmelidir.
- Anti faktör Xa testi için iki kez santrifüj edilmesi önerilir.



Örnek Hazırlama

- Ön hazırlık eipmanlar kalibrasyonlar
- Sekonder tüpler polipropilen olmalıdır.
- Polisitren olmamalıdır. Kapağının en kısa sürede kapatılması gereklidir.
- pH değişiminden korunmak için
- Referans değerin altındaki bir APTT değeri fibrin varlığı açısından ayrıntılı gözle değerlendirilmelidir.
- Pipet ile plasma örneği alınırken buff coat bütünlüğü bozulmamalıdır.

Hasta Kaynaklı Değişkenler-1

- Yaş, Cinsiyet
- Kan grubu (O grubu
- Hastanın kullandığı ilaçlar hormon terapisi
- Fiziksel aktivite
- Biyolojik varyasyon

Biyolojik Değişkenlere Göre Analitik Kalite Hedefleri

	Minimum	Optimum	Arzu edilen (desirable)
Biyolojik değişkenlik katsayılarına göre	$CV_A < \mathbf{0.75}\ CV_I$ $B_A < \mathbf{0.375}\ \sqrt{CV_I^2 + CV_G^2}$	$CV_A < \mathbf{0.25}\ CV_I$ $B_A < \mathbf{0.125}\ \sqrt{CV_I^2 + CV_G^2}$	$CV_A < \mathbf{0.50}\ CV_I$ $B_A < \mathbf{0.25}\ \sqrt{CV_I^2 + CV_G^2}$

Analit	**Biyolojik Varyasyon**		**Arzu edilen spesifikasyonlar**		
	Birey içi varyasyon (CVi)	Bireyler arası varyasyon (CVg)	İmpresizyon (%I) (min)	Sapma (%bias) (min)	TaE (%) (min)
Protrombin zamanı	4.0	6.8	2.0 (3)	2.0 (3)	**5.3 (10.26)**
aPTT	2.7	8.6	1.4 (2)	2.3 (3.4)	**4.5 (6.7)**
Fibrinojen	10.7	15.8	5.4 (8)	4.8 (7.15)	**13.6 (20.35)**

Hasta Kaynaklı Değişkenler -2

- Eritrosit sayısı anemi ve polisitemi
- Hematokrit
- Hastanın Htc değeri % 55 Den fazla ise ayarlama yapılması gerekri.
- Kabaca o.1 ul Na Sitrat atılır.
- C= 0.00185* (100 H) *V
- C= ml cinsinden % 3.2 Na-sitrat
- H= Htc
- V= ml cinsinden kan hacmi

Hasta Kaynaklı Değişkenler-3

- Sirkadian ritim
- Sabah hep aynı saat diliminde kan verme
- Aynı cihaz ve laboratuvarın tercih edilmesi
- Sigara fibrinojen artar plt aktive olur.
- Transfüzyonun etkisi

Red nedenleri

- PIHTI
- Yanlış antikoaglan
- Yanlış kan antikoagulan oranı
- Barkotsuz veya hatalı barkotlama
- Aşırı hemoliz
- Tam kan örneği olarak saklanmış veya dondurulumuş örnek
- PT test için çalışma öncesinde buzdolabında veya dondurulmuş örneklerden PT çalışılmamalıdır.

Red Nedneleri

- Bazı otomatik cihazlarda hemoliz ikter ve lipeminin cihaz üzerinden 340 405 575 ve 660nm de yaptığı çoklu dalga boyu ölçümlerinde ölçülerek örnek bütünlüğü değerlendilrir.
- Online preanalitik cihazalar ve otomatik santrifüj örnek alikotlaması gibi konularda da laboratuvara uzmanlarının dikkati olması gerekmektedir.

Preanalitik Evre Dış Kalite Kontrol

	Specimen	Pool	Result	Target	Specimen %bias	B score	C score
Haemolysis Index (g/L)	117A	152	0.03				
	117B	154	2.43	2.40	+1.3		
	117C	158	0.03				
Icterus Index (umol/L)	117A	152	18			+2.7	3.2
	117B	154	3				
	117C	158	299	290.4	+3.0		
Lipaemia Index (mmol/L)	117A	152	0.4			+9.6	7.4
	117B	154	0.6				
	117C	158	0.2				
Analyte 'X' ("units")	117A	152	26	23.63	+10.0		
	117B	154	21	21.42	-1.9		
	117C	158	23	23.18	-0.8		
Analyte 'X' Interpretation	117A	152	Y				
	117B	154	Y				
	117C	158	N				

Method Principle

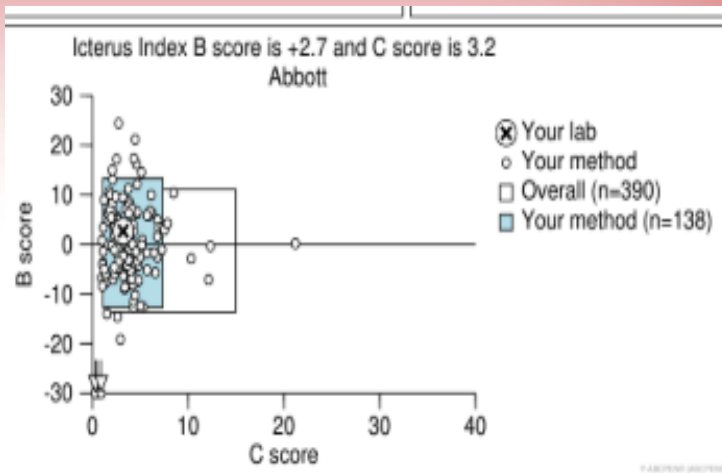
Haemolysis Index

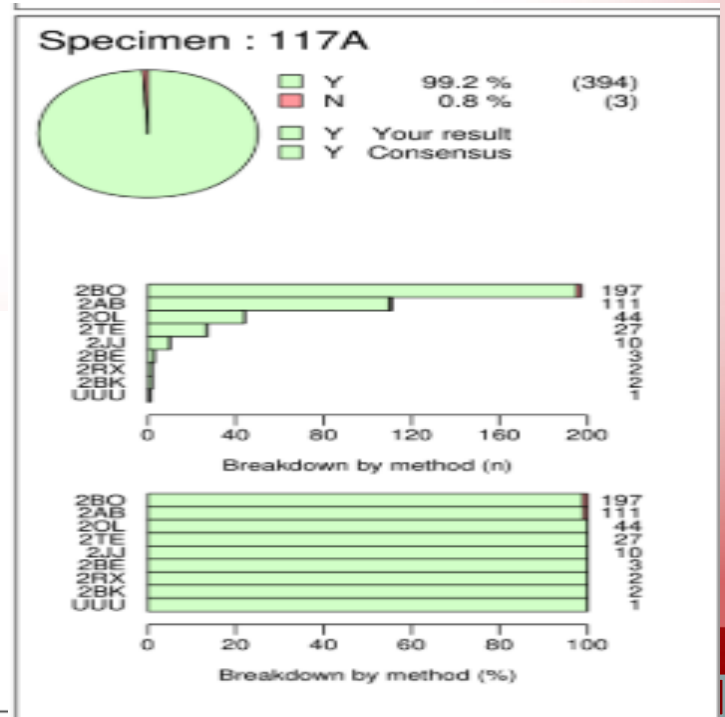
Icterus Index

Lipaemia Index

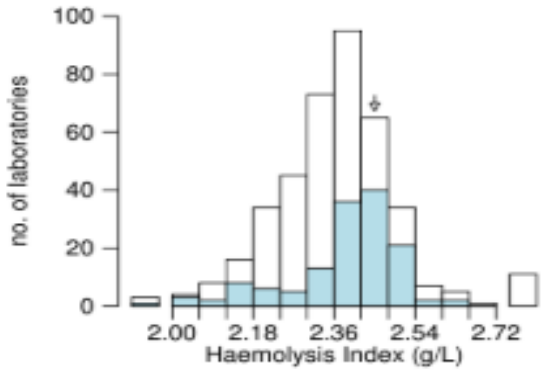
Analyte 'X'

Analyte 'X' Interpretation



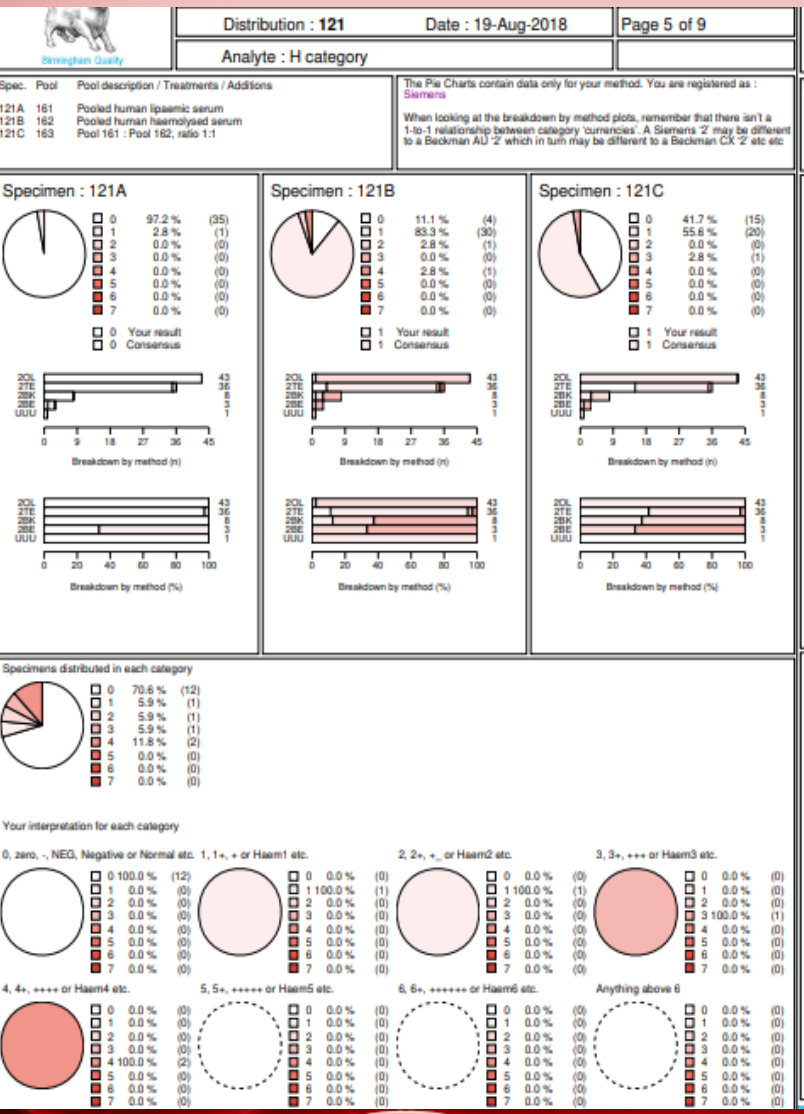


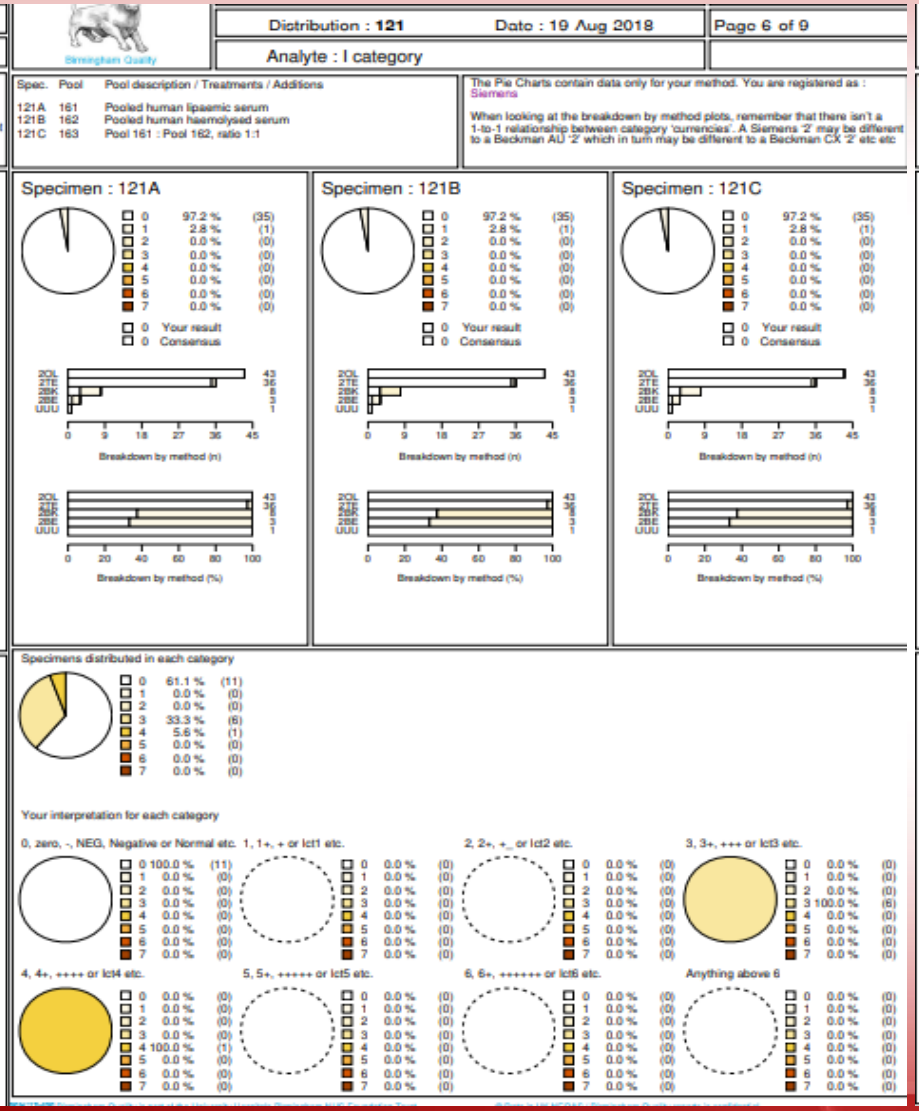
Specimen : 117B	n	Mean	SD	CV(%)
All methods [ALTM]	401	2.37	0.11	4.9
Abbott	139	2.40	0.11	4.5
J & J	12	2.36	0.29	12.2
Roche	233	2.34	0.09	4.0
Siemens	10	2.87	0.34	12.0

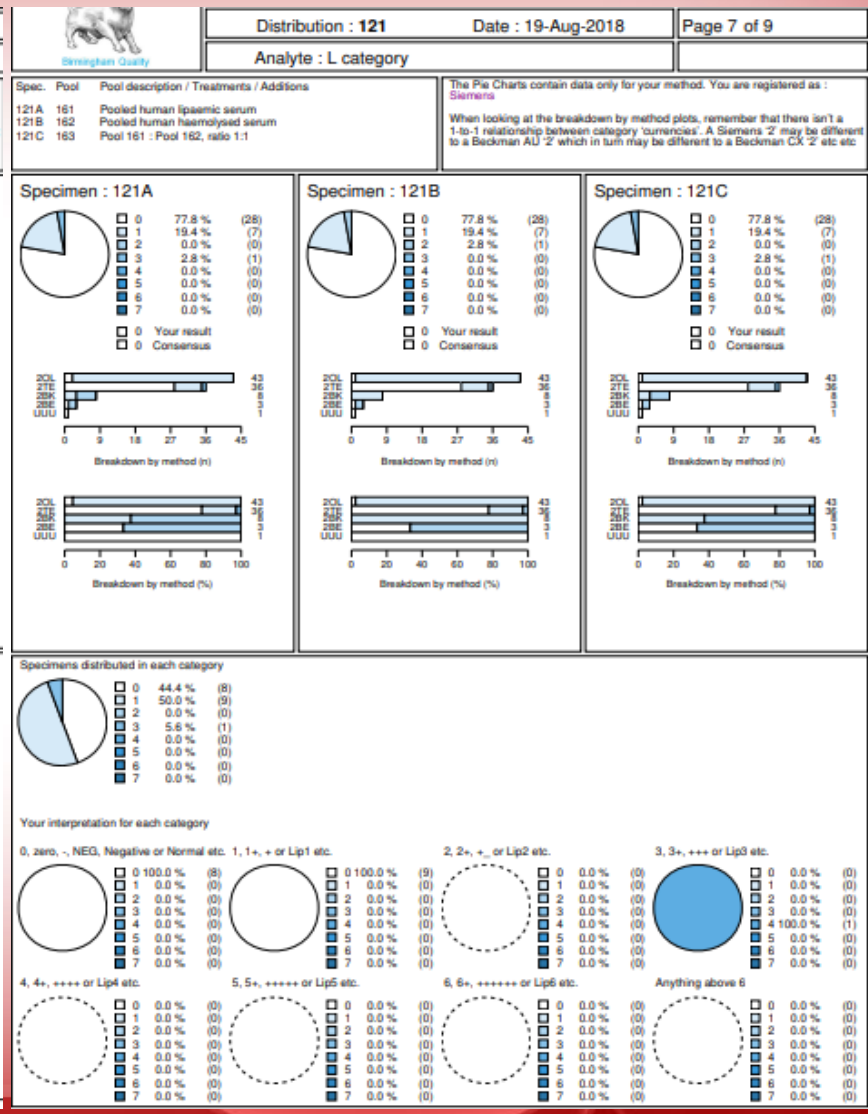


Your result	2.43
Target value (Abbott)	2.40
Your specimen: %bias	+1.3
ALTM	2.37
Your method mean (Abbott)	2.40

Preanalitik Evre Dış Kalite Kontrol







Akılcı test istemi

BMJ Qual Improv Rep. 2017 May 2;6(1). pii: u221651.w8161. doi: 10.1136/bmjquality.u221651.w8161. eCollection 2017.

REDucing Unnecessary Coagulation Testing in the Emergency Department (REDUCED).

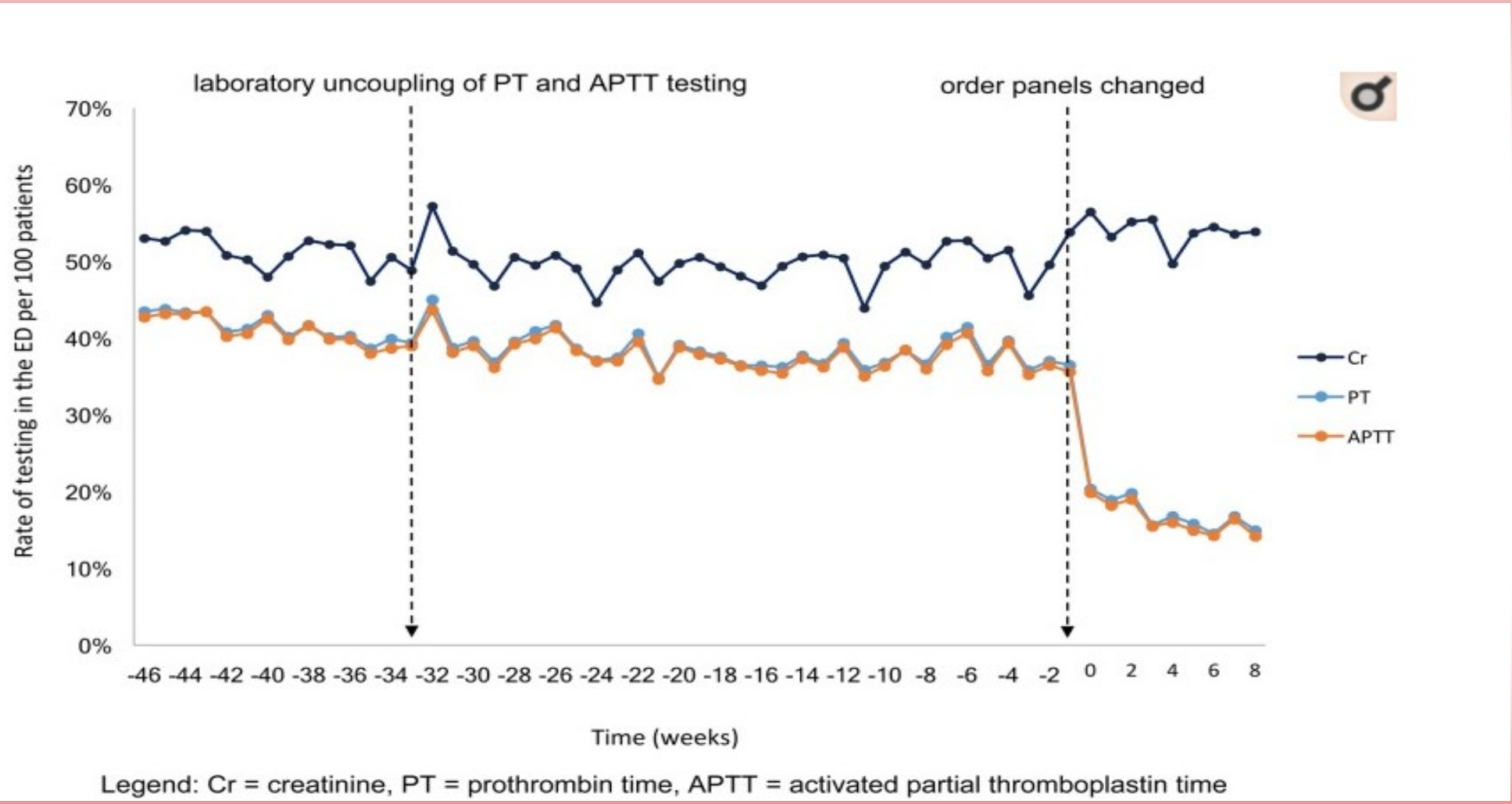
Fralick M[1], Hicks LK[1], Chaudhry H[1], Goldberg N[1], Ackery A[1], Nisenbaum R[1], Sholzberg M[1].

⊕ Author information

Abstract

The PT/INR (prothrombin time/international normalized ratio) and aPTT (activated partial thromboplastin time) were tests developed in the early 20th century for specific and unique indications. Despite this, they are often ordered together routinely. The objective of this study was to determine if a multimodal intervention could reduce PT/INR and aPTT testing in the emergency department (ED). This was a prospective multi-pronged quality improvement study at St. Michael's Hospital. The initiative involved stakeholder engagement, uncoupling of PT/INR and aPTT testing, teaching, and most importantly a revision to the ED order panels. After changes to order panels, weekly rates of PT/INR and aPTT testing per 100 ED patients decreased (17.2 vs 38.4, rate ratio=0.45 (95% CI 0.43-0.47), p<0.001; 16.6 vs 37.8, rate ratio=0.44 (95% CI 0.42-0.46), p<0.001, respectively). Rate of creatinine testing per 100 ED patients, our internal control, increased during the same period (54.0 vs 49.7, rate ratio=1.09 (95% CI 1.06-1.12); p<0.0001) while the weekly rate per 100 ED patients receiving blood transfusions slightly decreased (0.5 vs 0.7, rate ratio=0.66 (95% CI 0.49-0.87), p=0.0034). We found that a simple process change to order panels was associated with meaningful reductions in coagulation testing without obvious adverse effects.

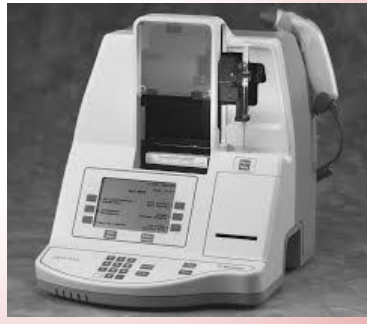
Akılcı test istemi



Fralick M, Hicks LK, Chaudhry H, Goldberg N, Ackery A, Nisenbaum R, Sholzberg M. REDucing Unnecessary Coagulation Testing in the Emergency Department (REDUCED). BMJ Qual Improv Rep. 2017 May 2;6(1). pii: u221651.w8161. doi: 10.1136/bmjquality.u221651.w8161.

POCT

- Üretici açısından değerlendirme
- Müşteri tarafından değerlendirmemesi
- PT APTT
- ACT- D-dimer
- Koagulasyon takibi
- İlaç
- İntrinsik yolak AcT, APTT Heparin tedavi
- Estrensek yolak Warfarin /VKA tedavisi için PT testi
- Ortak yol Hirudin ve DTII LMWH tedavisi ne ile takip edilmeli
- POC için CLSI POC 14A consencus candidate Limits



POCT

POC	Laboratuvar
Tam Kan	PPP
Antikoagulan yok	Sodyum sitrat antikoagulan
Dilusyon yok	9:1 oran dilüsyon oranı
Preanaltik dönem zaman kaybı yok	Değişken preanalytical dönem
Hemşire/ paramedik Kapiller tüp hızlı sonuç	Laboratuvar çalışanları Daha geç sonuç pıhtı riski

Sonuç

- Preanalitik hatalar laboratuvar hataları içerisinde en sık
- En sık koagülasyon test grubunda izlenir.
- Eğitim ve ekip çalışması

Teşekkürler