



Acil Servisdeki Preanalitik Sorunlar ve Çözüm Önerileri

Dr. Nedim Albayrak

Klinik İşler Müdürü

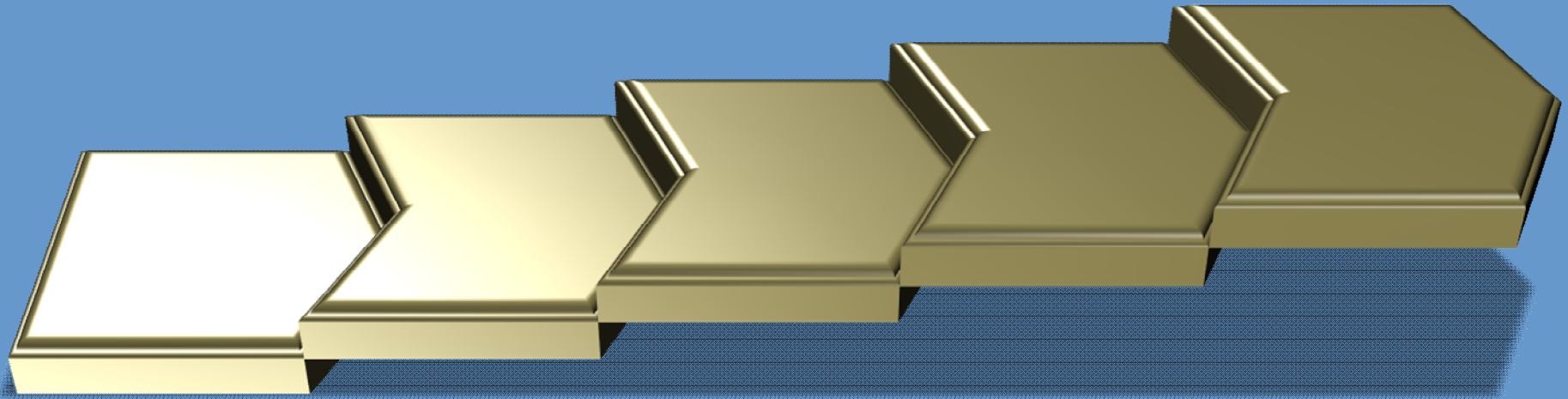
BD Diagnostics - Preanalytical Systems

Acil Servisde Numune Seçimi

- Numune seçiminde dikkat edilmesi gereken noktalar
 - Turnaround time (TAT, sonuç verme süresi)
 - Numune kalitesi (Hemoliz, fibrin)
 - Numune miktarı
 - Test sonuçlarına etkisi



Turnaround time (TAT)



Test İstemi

Kan Alımı

Laboratuvar
Kabul

Test Sonuç
Onaylama

Sonucun
Sistemde
Görülmesi

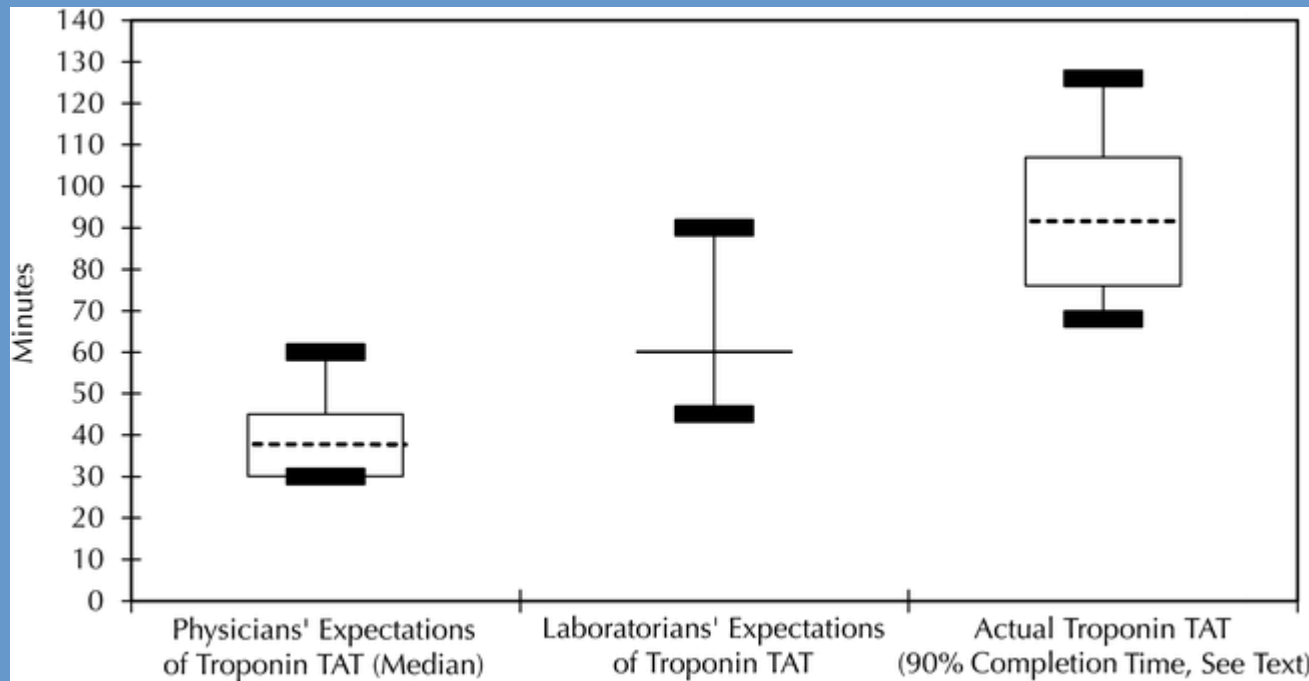
TAT

TAT

TAT

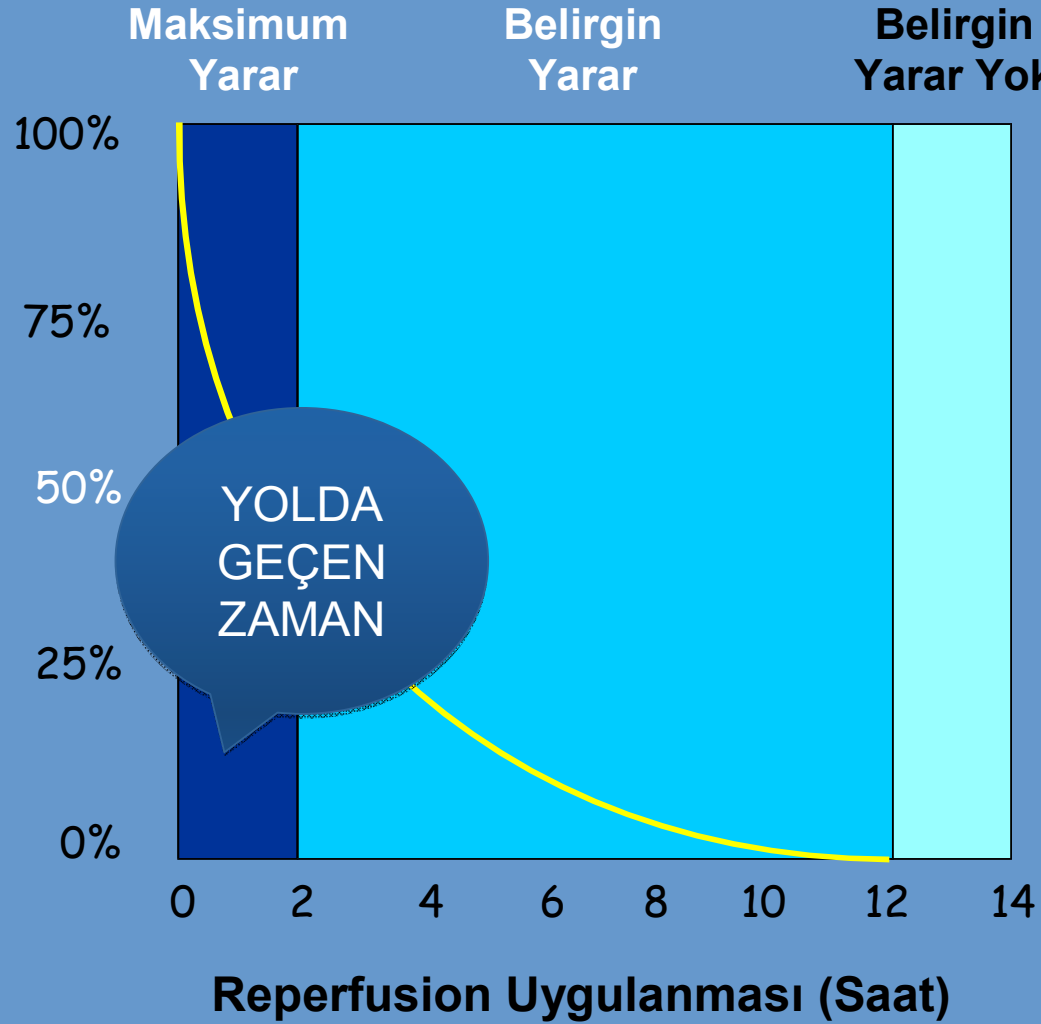
Kardiak Marker TAT'ın Hasta Sağlığı İçin Önemi

Klinisyenlerin median TAT beklentisi karşılanamayabilir.



Novis D.A et al. Biochemical Markers of Myocardial Injury Test Turnaround Time: A College of American Pathologists Q-Probes Study of 7020 Troponin and 4368 Creatine Kinase-MB Determinations in 159 Institutions. Arch Pathol Lab Med 2004; 128:158-64.

AMI – Erken Teşhisin Yararları

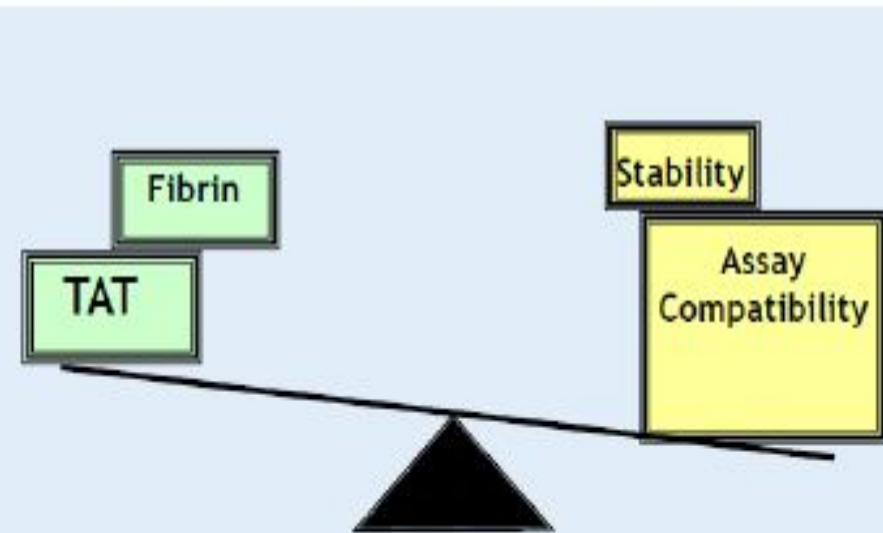
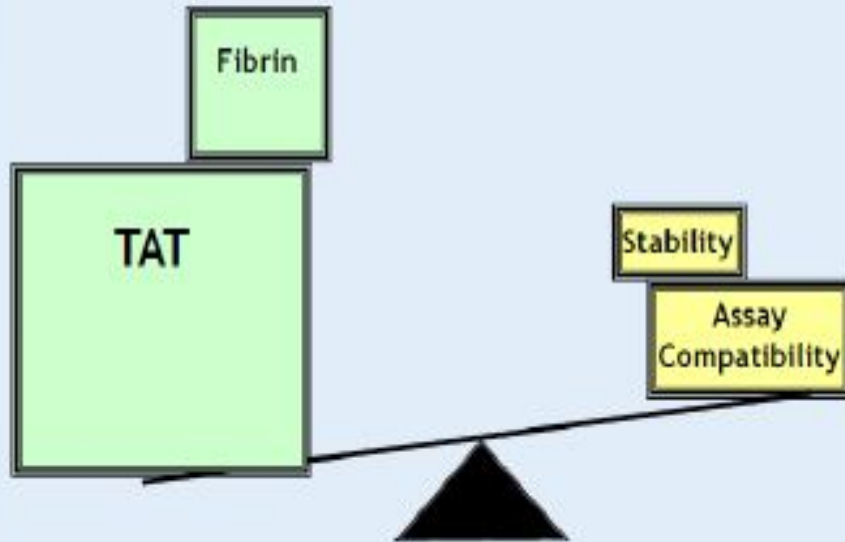


Erken ve etkili tanı konması başarılı bir tedavi için çok kritik bir öneme sahiptir!

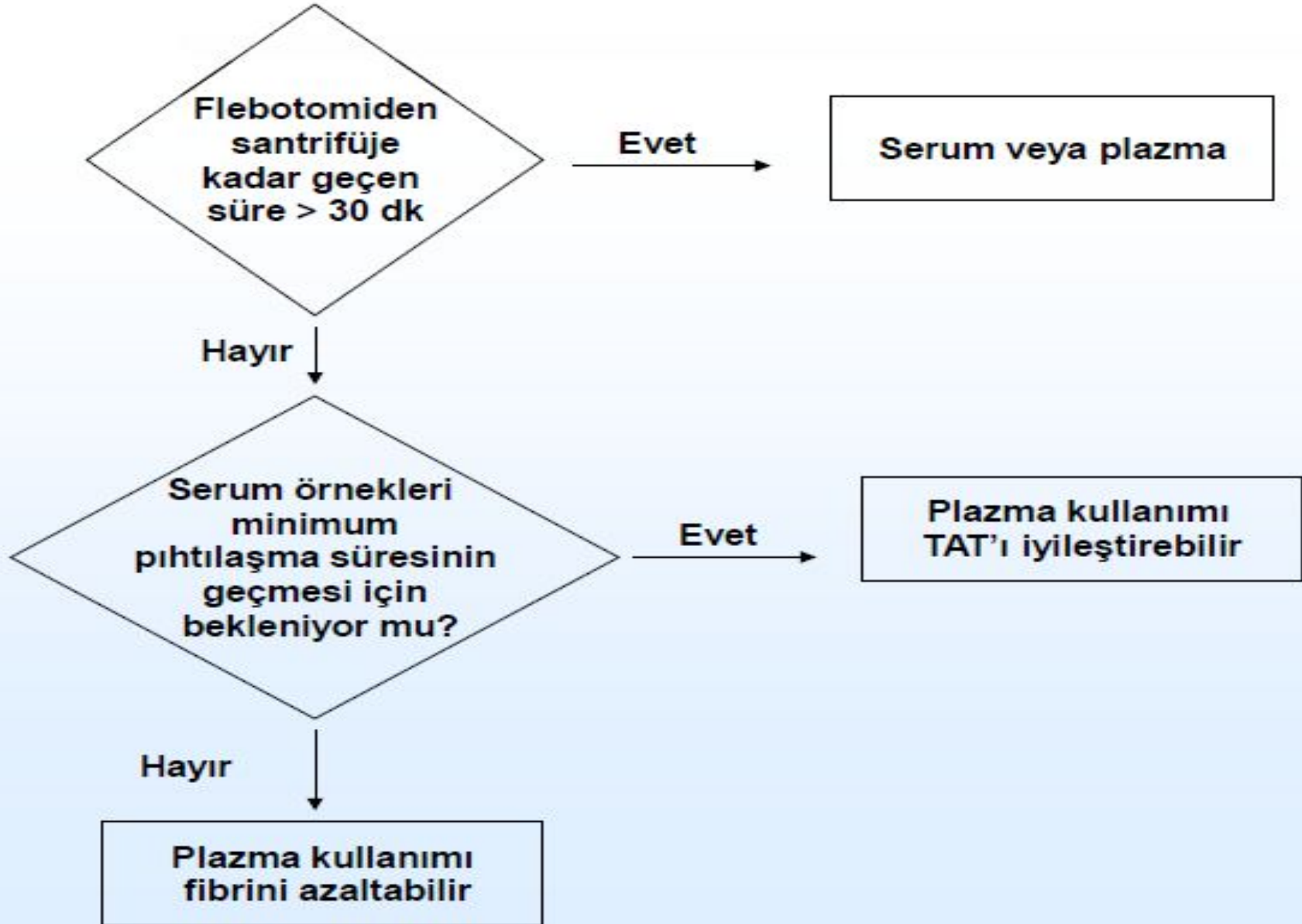
Adaptasyon:
National Heart Attack Alert Program Coordinating Committee, "Emergency Department; Rapid Identification and Treatment of Patients with Acute Myocardial Infarction", National Heart, Lung and Blood Institute, National Institute of Health, September 1993.



Hangisini Tercih Edelim?



Algoritma – Numune Türünün Seçimi



Her İkisine Sahip Olamaz mıyız?

Plazmanın
Hızı

Serum Test
Uyumluluğu



When appropriate, a collection device can be used that contains an activator to accelerate clotting (eg, snake venom/thrombin, approximately two to five minutes; thrombin, approximately five minutes; and glass or silica particles, 15 to 30 minutes).^{6,49-52}

to accelerate
approximately five

References: Procedures for the Handling and Processing of Blood
6th edition CLSI H18-A4 sayfa-6

th

Daha Kısa TAT

5 DK **3*** DK = Yalnızca **8** dakika

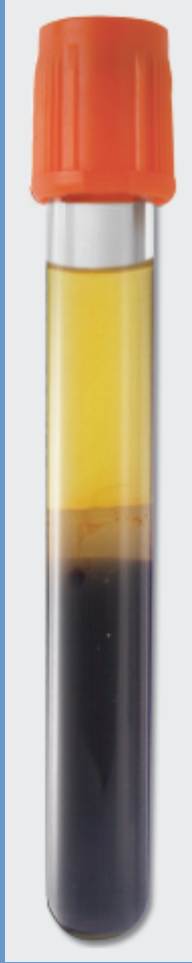
Thrombin ile 32 dakikalık kazanç



* 4000 g'de

30 DK **10** DK = **40** dakika

Thrombin Tüplerin Potansiyel Avantajları



5 dk. Pıhtılaşma Süresi

Berrak Serum
↓Fibrin ↓Hemoliz

Cihazların "Downtime" Azalma

Daha az tekrar kan alma

Hızlı Sonuç Verme

Hemolizde Azalma

Hemolysis

Hemolysis was rated on a scale of 0 - 3 (0 = none, 1 = trace, 2 = moderate, 3 = gross).

| | | 0 | | 1 | | 2 | | 3 | |
|-------|-----------------------|------|-------|----|------|---|------|---|------|
| Study | Tube Type | N | % | N | % | N | % | N | % |
| Total | BD RST HG | 1103 | 98.84 | 12 | 1.08 | 1 | 0.09 | - | - |
| | Comparator Serum Tube | 724 | 97.18 | 16 | 2.15 | 3 | 0.40 | 2 | 0.27 |

There is a significant difference between the BD RST HG and the comparator serum tube (logistic regression p-value = 0.0112) regarding the presence of hemolysis. BD RST HG had fewer hemolysis ratings above 0 than the comparator serum tube. There was a 1.65% decrease in the presence of hemolysis, a relative decrease of 58.7%, with the BD RST HG in relation to the comparator serum tube.

- İstanbul Mehmet Akif Ersoy Göğüs Kalp ve Damar Cerrahisi Eğitim ve Araştırma Hastanesi Pediatri Yoğun Bakım servisinde 3 gün boyunca sabah 7.00'de toplam 243 adet kan örneği 114 adet jelli vakumlu tüplere(SST. BD. ABD) ve 129 adet hızlı pıhtılaştırıcı trombinli jelli tüplere (RST.BD.ABD) alınmış ve pnömatik sistem ile laboratuvara transfer edilmiştir. Pediatrik örnekler hemoliz yönünden değerlendirildiğinde her iki tüp karşılaştırıldığında istatistiksel olarak anlamlı farklılık görülmemiştir(p=0.2).Ancak hızlı pıhtılaştırıcı trombinli jelli tüplere alınan örneklerde %48 rölatif azalma görülmüştür.

Fibrinde Azalma

Fibrin Strand

Fibrin strand was rated on a scale of 0 - 2 (0=none, 1=small/thin strand, 2=large/thick strand).

| | | 0 | | 1 | | 2 | |
|-------|-----------------------|------|-------|----|------|---|------|
| Study | Tube Type | N | % | N | % | N | % |
| Total | BD RST HG | 1080 | 96.77 | 36 | 3.23 | - | - |
| | Comparator Serum Tube | 687 | 92.21 | 54 | 7.25 | 4 | 0.54 |

There is a significant difference between the BD RST HG and the comparator serum tube (Wilcoxon Mann-Whitney test exact p-value = 0.0005) regarding the presence of fibrin strands. BD RST HG had fewer fibrin strand ratings above 0 than the comparator serum tube. There was a 4.56% decrease, a relative decrease of 58.6%, in the presence of fibrin strand with the BD RST HG in relation to the comparator serum tube.

Thrombin ile ille False (+)de Azalma

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[Clin Biochem](#). 2012 Jul;45(10-11):842-4. doi: 10.1016/j.clinbiochem.2012.04.014. Epub 2012 Apr 26.

BD rapid serum tubes reduce false positive plasma troponin T results on the Roche Cobas e411 analyzer.

Koch CD, Wockenfus AM, Saenger AK, Jaffe AS, Karon BS.

Department of Laboratory Medicine and Pathology, Mayo Clinic, Rochester MN 55905, USA.

Erratum in

[Clin Biochem](#). 2013 Jan;46(1-2):187.

Abstract

OBJECTIVES: In an attempt to reduce false positive results and improve turnaround time, we investigated the BD Rapid Serum Tube as an alternate sample type to lithium heparin plasma for Roche Troponin T analysis on the Roche Cobas e411 analyzer.

DESIGN AND METHODS: BD Plasma Separator Tubes (PST) and Rapid Serum Tubes (RST) were collected in tandem from Emergency Department patients who had clinical orders for Troponin T over a 1 month period.

RESULTS: RST and PST samples yielded analytically and clinically concordant Troponin T results on the Roche Cobas e411. Rare false positive results in lithium heparin samples were not observed with rapid clot serum tubes.

CONCLUSIONS: RST samples are appropriate for stat Troponin T analysis, and appear to reduce the incidence of rare false positive Troponin T results obtained with lithium heparin samples.

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PMID: 22561083 [PubMed - indexed for MEDLINE]

<http://www.ncbi.nlm.nih.gov/pubmed/22561083>

Thrombin ile ile False (+)de Azalma

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[Am J Clin Pathol](#). 2011 Aug;136(2):325-9. doi: 10.1309/AJCPZOFJ7KX5QMRW.

Use of the BD vacutainer rapid serum tube reduces false-positive results for selected beckman coulter Unicel Dxl immunoassays.

[Strathmann FG](#), [Ka MM](#), [Rainev PM](#), [Baird GS](#).
Laboratory Medicine, University of Washington, Harborview Medical Center, Seattle, WA 98104, USA.

Abstract
We investigated the use of serum samples from BD Vacutainer rapid serum tubes (RSTs; BD, Franklin Lakes, NJ) to reduce undetermined interferences contributing to false-positive immunoassay results in heparin plasma samples. Patients being evaluated for suspected myocardial infarction had specimens drawn into an RST in addition to the standard lithium-heparin plasma separator tube (PST). We measured 28 separate analytes in both specimens using immunoassay, electrochemical, and spectrophotometric methods. Higher results were observed in some PST specimens tested for troponin I, creatine kinase-MB isoenzyme, human chorionic gonadotropin, and thyroid-stimulating hormone. These discrepancies were investigated by repeating analyses after recentrifugation of both specimens. Reanalysis gave results for the PST specimens that were lower and agreed well with initial results from RSTs, suggesting false-positive rates of 10.8% for troponin I and about 2% for each of the other 3 analytes. Overall, specimens collected in RSTs had fewer false-positive immunoassay results than specimens collected in plasma separator tubes.

PMID: 21757607 [PubMed - indexed for MEDLINE] [Free full text](#)

MeSH Terms, Substances

LinkOut - more resources

Daha Kısa Sürede Sonuç Vermek

- Thrombin-Accelerated Clotting Improvements in Preanalytic Phases: improved serum indices, shortened turnaround times
- **Bakan, Ebubekir**¹, Ozturk, Nurinnisa ¹, Dorman, Emrullah¹, Polat, Harun¹, Baygutalp, Nurcan Kilic¹
- ¹Ataturk University Medical School, Medical Biochemistry Department, Erzurum, Turkey
- Presented at 3rd. EFLM – BD European Conference on Preanalytical Phase, Porto, 2015. Poster# 39
- **Conclusion:** Using quick clotting, RSTs potentially provide shorter TAT, being suitable especially for emergency samples. The net result of the RST usage for emergency samples is a total TAT improvement comprising of analytical as well as pre-analytical phases.

Thrombin-Accelerated Clotting Improvements in Preanalytic Phases: improved serum indices, shortened turnaround times

Background

Results

Materials and Methods

Conclusions

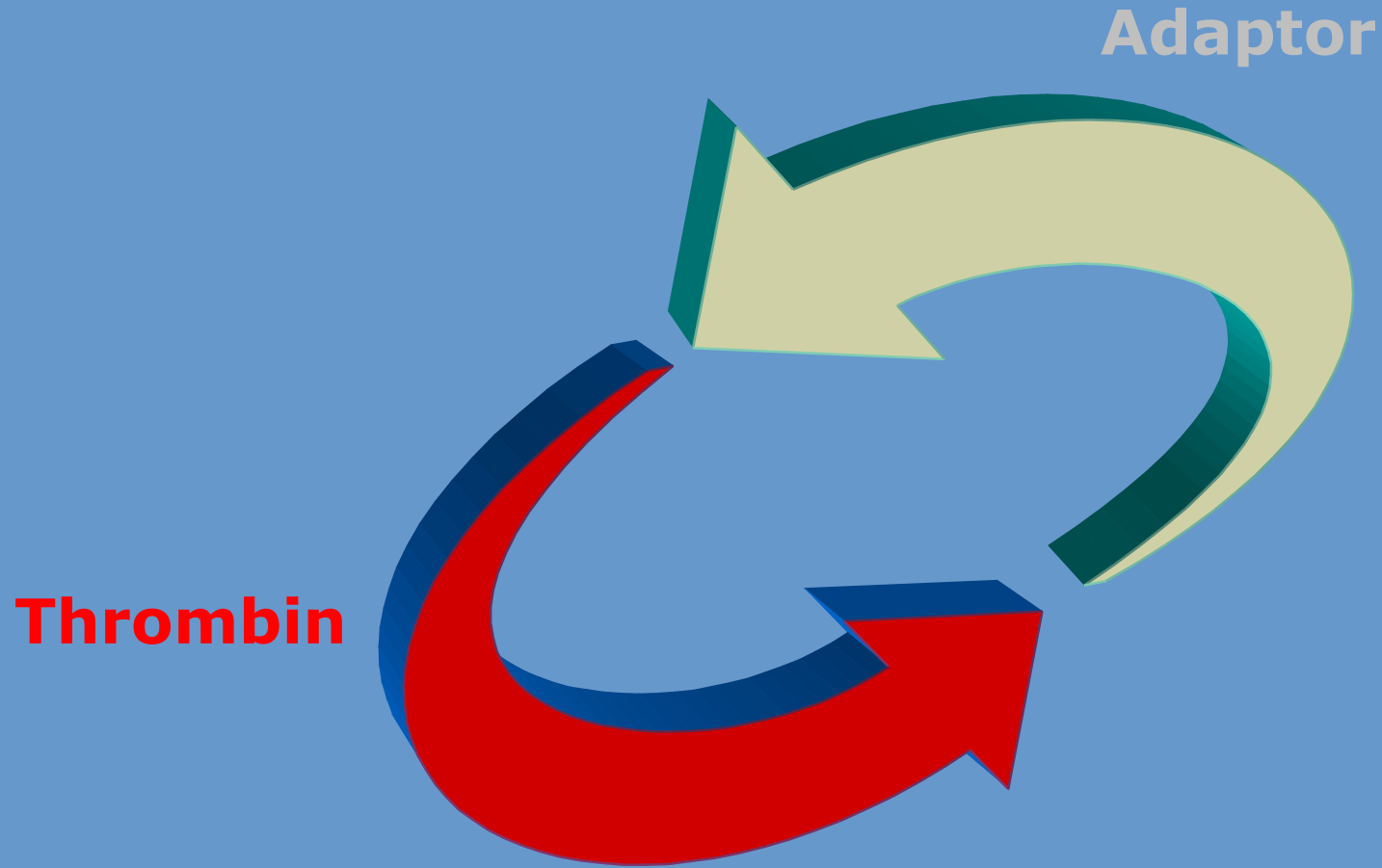
| Parameter | RST | Control | Emergency | P-value |
|-------------------------------|------|---------|-----------|---------|
| PT | 0.00 | 0.00 | 0.00 | 0.000 |
| APTT | 0.00 | 0.00 | 0.00 | 0.000 |
| TT | 0.00 | 0.00 | 0.00 | 0.000 |
| Fibrinogen | 0.00 | 0.00 | 0.00 | 0.000 |
| D-Dimer | 0.00 | 0.00 | 0.00 | 0.000 |
| PT/APTT | 0.00 | 0.00 | 0.00 | 0.000 |
| TT/Fibrinogen | 0.00 | 0.00 | 0.00 | 0.000 |
| PT/APTT/TT | 0.00 | 0.00 | 0.00 | 0.000 |
| PT/APTT/TT/Fibrinogen | 0.00 | 0.00 | 0.00 | 0.000 |
| PT/APTT/TT/Fibrinogen/D-Dimer | 0.00 | 0.00 | 0.00 | 0.000 |

Cihazların “Downtime”da Azalma

- Thrombin-Accelerated Quick Clotting improvements in preanalytical phases of Clinical laboratory: Improved instrument downtime.
- **Ozturk, Nurinnisa¹**, Bakan, Ebubekir¹, Dorman, Emrullah¹, Baygutalp, Nurcan Kilic¹, Polat, Harun¹
- ¹Ataturk University Medical School, Medical Biochemistry Department, Erzurum, Turkey
- Presented at 3rd. EFLM – BD European Conference on Preanalytical Phase, Porto, 2015. Poster# 38
- **Conclusion:** This study is the first to make a relation of RST sampling to analyser downtime on the basis of ISE slope values. In addition, we can conclude that turbid or low-quality serum samples may result in not only high numbers of downtimes but also other potential contaminations, all of which exaggerate the downtime number of analytical systems.



İkinci Çözüm Önerisi (Sinerji)

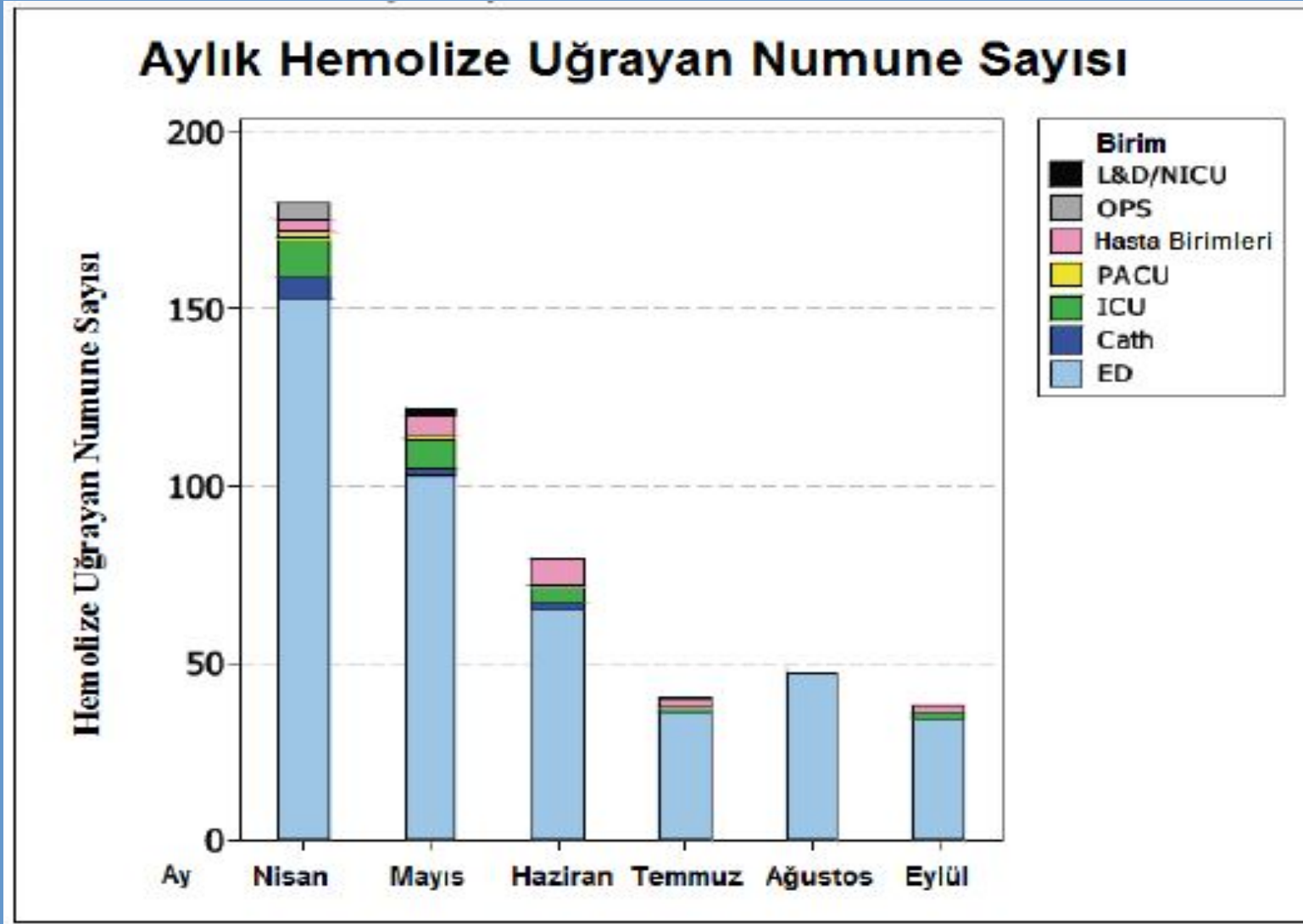


Hemolizi Azaltmaya Yönelik Çözüm

- Damar yolu açılmış hastalar (acil ünitesi, servisler, yoğun bakım)
- Özellikle IV line veya dişi bir luer bağlantı noktasına vidalanır / takılır ve kan numunesi alınabilir.



Hemolizde %78 Azalma



1+1= 4



- Assessment of the effect for combined use of BD Vacutainer® Rapid Serum Tube and Luer-lok adapter on the rate of hemolysis in the emergency department.
- Asım OREM, Hüseyin YAMAN, Süleyman Caner KARAHAN, Yüksel ALIYAZICIOGLU
- Karadeniz Technical University, Faculty of Medicine, Department of Medical Biochemistry, Trabzon, Turkey.
- Presented at 3rd. EFLM – BD European Conference on Preanalytical Phase, Porto, 2015. Poster# 71

| | Total number | Hemolyzed number | Hemolyzed ratio (%) |
|-----------------------------|--------------|------------------|---------------------|
| SST II (1. period) | 3776 | 916 | 24.26 |
| RST (2. period) | 3582 | 763 | 21.30 |
| RST + Luer lock (3. period) | 3795 | 464 | 12.23 |

| | Differences (%) | p |
|--------------------------|-----------------|--------|
| RST - SST II | 12.2 | < 0.01 |
| RST + Luer lock - RST | 42.6 | < 0.01 |
| RST + Luer lock - SST II | 49.6 | < 0.01 |

Özet

- Silica (p1ht1 aktivatörü) içeren, kan alma tüplerinde p1ht1laşma süresi kaç dakikadır?
a- 15dk. b- 30dk. c- 45dk. d-60dk.
- Thrombin katkı maddesi içeren, kan alma tüplerinde p1ht1laşma süresi kaç dakikadır?
a- 5dk. b- 15dk. c- 30dk. d-45dk.
- Thrombinli tüplerin kullanımı ile silicalı (p1ht1 aktivatörlü) tüplere göre kaç dakika kazanç elde edebilirsiniz?
a- 12dk. b- 32dk. c- 42dk. d-52dk.
- Kateterlerden kanın, kan alma tüplerine aktarılması için enjektör dışında başka bir aparat kullanılabilir mi?
a- EVET b- HAYIR

Teşekkür ederim...

Serum – Plazma - Thrombin

| Özellikler | Serum | Plazma | Thrombin |
|--|-------|--------|----------|
| ≤ 5 dk. numunenin hazır olması | | √ | √ |
| Santrifuj ≥ 3 dk. | | | √ |
| Kalan süpernatant her ml kan için | | √ | |
| Nerdeyse hücresiz | √ | | √ |
| Azalmış fibrin | | | √ |
| Azalmış Hemoliz | | | √ |
| Birçok test uyumluluđu | √ | | √ |
| Analitlerin stabilitesi | √ | | √ |
| Saklama koşullarının minimize edilmesi | √ | | √ |

Back Up

Reducing PAV: Sample Processing



- Latent Fibrin/Fibrin Mass Formation:
- Solutions: To clot or not to clot?
- Anticoagulant Lithium Heparin
- Rapid collecting additive such as thrombin or heparin neutralisers such as protamine

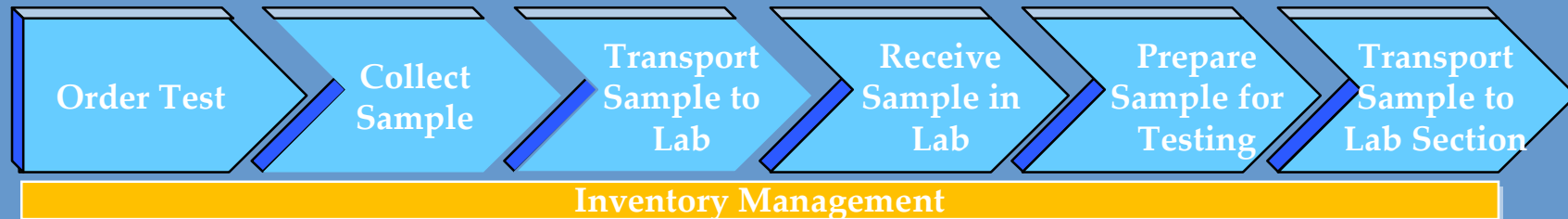


Table 2: Clotting time (seconds) summary statistics

| | BD RST | BD SSTII |
|---------|--------|----------|
| Mean | 152 | 527 |
| StDev | 46 | 155 |
| Median | 155 | 479.5 |
| Minimum | 54 | 275 |
| Maximum | 240 | 935 |
| N | 32 | 32 |

Visible clotting was achieved rapidly in RST specimens within 5 min where participants had received a total of 0 to 5000 units of heparin) but not from participants who received a total of 7000 units of heparin (APTT >150 s).²

Example Bullet Point Slide



- Select test
- Complete order form
- Receive test order
- Deploy staff for collection
- Note urgency level
- Collect supplies

- Locate patient
- Prep patient
- **Draw appropriate specimen**
 - Bedside
 - Home
 - Doctor's office
 - Draw station
- Label
- Dispose of supplies

- Prioritize sample for transport
- **Send sample to lab**
 - Pneumatic tube
 - Robot
 - Hand carry
 - Courier
- **Allow serum sample to clot**

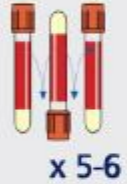
- Accession
- Apply/verify sample label
- Bar code for testing
- **Identify STAT tests**
- Rack sample

- **Centrifuge**
- Aliquot
- Pre-treat
- Re-rack
- **Reject for poor quality**

- Send sample to appropriate lab section
 - Main lab
 - Reference lab
- Re-rack

Thrombin Tüp Numune Hazırlanması

5-6
kez ters
düz edin



Pıhtı etkinleştiricinin kanla karışması için 5-6 kez yavaşça ters-düz edin



5
dakikada
pıhtılaşma



- Tüp dikey konumdayken kanı en az 5 dakika süreyle pıhtılaşmaya bırakın
- Yoğun bir pıhtı oluşumunu görün














En az
3
dakika
santrifüj



- 23-27°C'da, 3 dakika 4000g'de, 4 dakika süreyle 2000g'de veya 10 dakika süreyle 1500-2000g'de santrifüj uygulayın (tüpü santrifüje dengeli yerleştirin)
- Serum örneğini pıhtıdan ayıran bariyer oluşumunu gözlemleyin
- Santrifüje edilmiş olan tüpü laboratuara gönderin.



| Colour Code | Tube Type | Inversions |
|---|--------------------|------------|
|  Light Blue | Sodium Citrate | 3-4 Times |
|  Black | Sodium Citrate ESR | 8-10 Times |
|  Orange | RST™ | 5-6 Times |
|  Red | Serum | 5-6 Times |
|  Gold | SST™ II | 5-6 Times |
|  Green | Heparin & PST™ II | 8-10 Times |
|  Lavender | EDTA | 8-10 Times |
|  Pearlescent | PPT | 8-10 Times |
|  Pink | Cross Match | 8-10 Times |
|  Grey | Fluoride Oxalate | 8-10 Times |
|  Royal Blue | Trace Element | 8-10 Times |