Çoklu Travma Hastalarında Prognoz Belirteçleri

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Acıbadem Üniversitesi Acil Tıp AD

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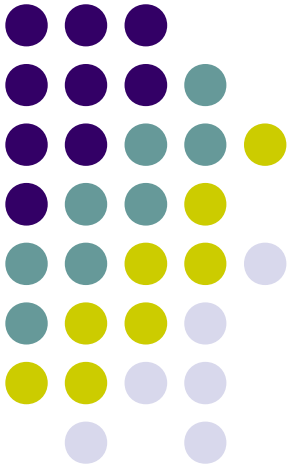


IX. Ulusal Acil Tıp Kongresi

ATUDER Acil Tıp Uzmanları Derneği

23-26 Mayıs 2013

Titanic Deluxe Belek, Antalya

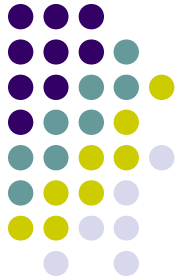
Sunum Planı

- Çoklu Travma Mekanizma
- Çoklu Travma Patofizyolojisi
- Kötü Prognoz ve Şok
- Belirteçleri (marker)
- Belirteçlerin Geleceği

Çoklu Travma Mekanizması

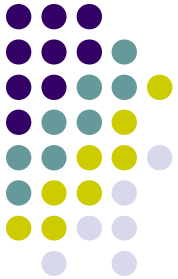
- Çoklu travmaların % 26'sı AİTK
- Künt veya penetran çoklu travmada SONUÇ:
  - *Primer doku hasarı*
  - *Kanama*
- Yaralanma tipi ne olursa olsun ölümlerin ana sebebi ***HİPOVOLEMİ***
- Tek epizod hipotansiyon mortaliteyi % 50 ↑

Çoklu Travma Yönetimi



- Tüm ATLS kurallarını uygulamaya ve agresif tetkik etmeye rağmen erken fazda doğru tanının atlanabilmesi HALA olasıdır.
- Geniş serili yapılan çalışmalarda travma hastalarında önlenebilir ölümün en sık sebebi İNSAN HATASIDIR!

Travma Resüsitasyonunda Hedef



1. Primer doku hasarı sonrası önlenebilecek sekonder doku hasarının engelleme

2. Kanama sonucu oluşan doku hipoperfüzyonunu düzeltme

Kötü prognoz ve şok

Nasıl tanıyacağız...

- Kan basıncı?
- Nabız?
- Kapiller dolum?
- Şok indeks?

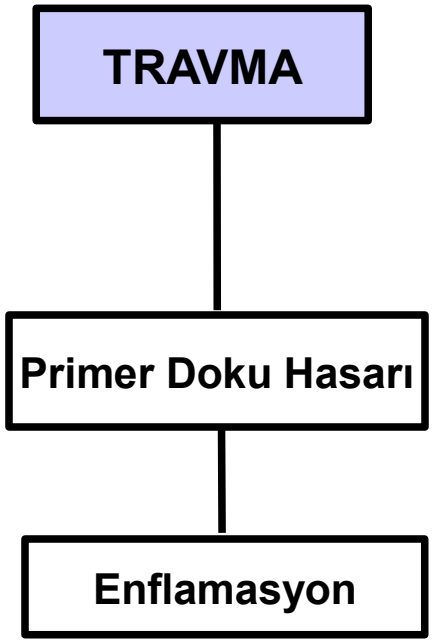
Heart Rate: Is It Truly a Vital Sign?

Karen J. Brasel, MD, MPH, Clare Guse, MS, Larry M. Gentilello, MD, and Ram Nirula, MD, MPH

J Trauma. 2007;62:812–817.

Conclusions: Heart rate alone is not sufficient to determine the need for emergent interventions for hemorrhage. Although tachycardia may still indicate need for emergent intervention in the trauma patient, its absence should not allay such concern.

Travma Patofizyolojisi



Birçok enflamatuvar belirteç (akut faz reaktanları, sitokinler, mediatörler) bu süreçte dolaşıma salınır:

- CRP, Fibrinojen, Procalsitonin
- TNF, IL-1, IL-6, IL-10, IL-18
- TNF-RI, TNF-RII, IL-1R-1, IL-1R-II, s-IL6-R, mIL-6-R, ICAM-1, Eselectin, CD11b, elastase, HLA-dr class-II antijen, cell-free-DNA

Kötü prognoz ve şok

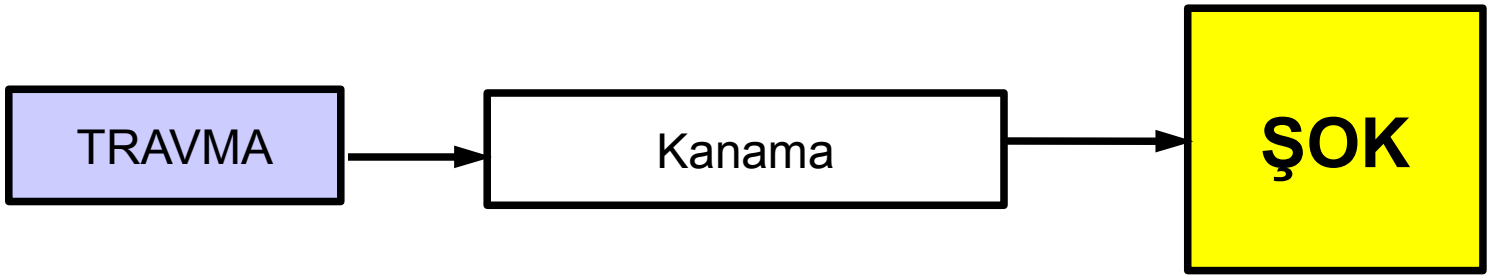
Nasıl tanıyacağız...

- Kan basıncı?
- Nabız?
- Kapiller dolum?
- Şok indeks?

Kompansasyon

- Kardiyovasküler
- Renal
- Solumsal
- Otonom sinir sis.
- Endokrin
- Koagülasyon

Travma Patofizyolojisi



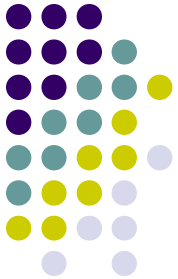
MORTALİTENİN EN SIK SEBEBİ

Kötü prognoz ve belirteçler

- Tüm kompansatuvar mekanizmalar çoklu travmada kötü prognozu ve şok gelişimini maskeleyebilmektedir.

- Sistemik ve fokal belirteçlerle (marker) çoklu travma hastasında kötü prognozu erken tanı ve tedaviyi başarısını takip etmek amaçlanmaktadır.

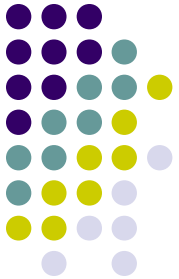
Gizli Hipoperfüzyon



· Normal ya da görece normal vital bulgu varlığında *yetersiz organ ve doku perfüzyonu* tespitinde:

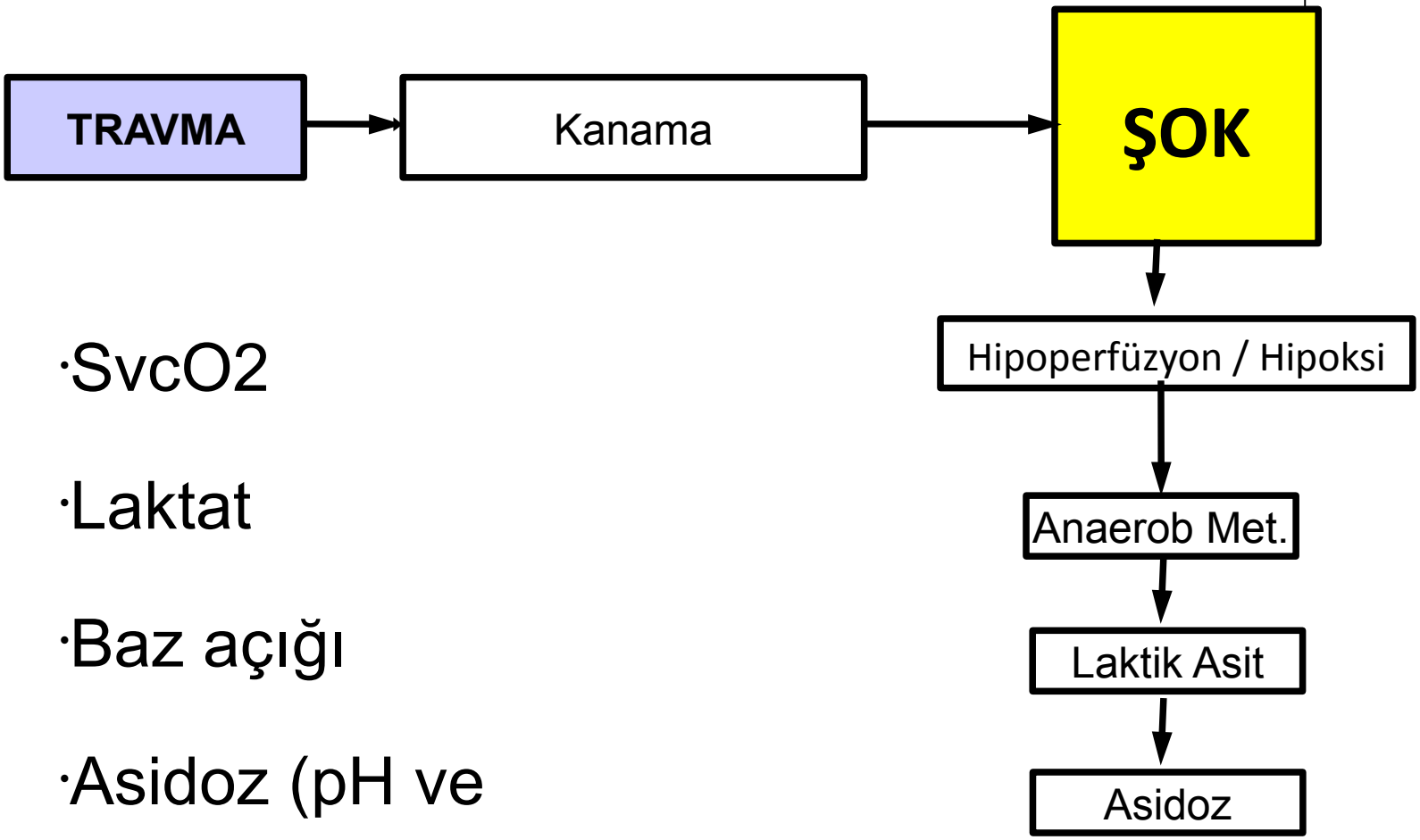
- Fizik muayene bulguları
- Doku hipoperfüzyonunu gösteren bazı *metabolik belirteçler*

Prognostik Belirteçlerde Hedef



- Erken tanıma:
  - Doku hipoksisi ve asidozu
  - Koagülopatiyi
  - Doku hasarını
  - Çoklu organ yetmezliğini
  - Resüsitasyon yeterliliği ve başarısını

Hipoperfüzyon Belirteçleri



- SvcO2
- Laktat
- Baz açığı
- Asidoz (pH ve bikarbonat)

Santral Venöz O2 Saturasyonu

- Oksijen ihtiyacı ve tüketiminin vücuttaki hassas dengesini gösteren bir belirteç
- SmvO2 = SvcO2 = % 70-75
- Ölçüm santral kateterle VCS veya RA
- SvcO2 < % 70
  - hipoperfüzyon ve doku hipoksisi
  - epilepsi

Santral Venöz O2 Saturasyonu

Low central venous oxygen saturation in haemodynamically stabilized trauma patients is associated with poor outcome

Hosking, C. 1,*; Wilander, P. 2,*; Goosen, J. 1; Jacobson, H. 1; Moeng, M. 1; Boffard, K.

Acta Anaesthesiologica Scandinavica. 55(6):713-721, July 2011.

Haemodynamically unstable trauma patients receiving a central venous line within 1 h of admission were eligible for inclusion in this prospective observational study. The mean arterial pressure (MAP), lactate and ScvO2 were recorded at inclusion and every 6 h for 36 h or until lactate was <2.0 mmol/l and ScvO2 was >75% in two consecutive measurements. Patients with a MAP of >=70 mmHg were considered to be haemodynamically stabilized. The outcome measure was complications defined as infections, multi organ failure and mortality.

Hemodinamik olarak stabilize edilen travma hastalarında düşük ScvO2 değerleri daha fazla komplikasyon ve kötü sonuçlarla ilişkilidir. **ScvO2 travma resüsitasyonunda potansiyel bir son nokta olarak kullanılabilir.**

Laktat

- Laktat, hücresel oksijenlenmenin bozulmasını (doku hipoksisi) kritik göstergesidir.
  - Normal 0,5 -1,5 mg/dL
  - Anormal > 2 mg/dL
  - Ciddi > 4
- Arteriyel kan gazı şart değil. Venöz kanda da çalışılabilir. →
- Ciddi Laktik Asidoz SvcO2 < % 50

Peripheral venous and arterial lactate agreement in septic patients in the Emergency Department: a pilot study

Robert Browning[a], Deepankar Datta[c], Alasdair J. Gray[c] and Catriona Graham[b]

European Journal of Emergency Medicine 00:000–000

This pilot study demonstrates the potential use of PV-LACT as a useful substitute for A-LACT measurement in septic patients presenting to the ED. The use of PV-

Can we predict arterial lactate from venous lactate in the ED?

Mikami A, Ohde S, Deshpande GA Mochizuki , Otani N Ishimatsu S

Am J Emerg Med. 2013 May 17. pii: S0735-6757(13)00188-5.

CONCLUSION: v-Lac estimates showed a high correlation with arterial values and might be more useful while avoiding a time-consuming and invasive procedure.

Lactate clearance as a predictor of mortality in trauma patients

Stephen R. Odom, MD, Michael D. Howell, MD, MPH, George S. Silva, BA, Victoria M. Nielsen, Alok Gupta, MD, Nathan I. Shapiro, MD, MPH, *and* **Daniel Talmor, MD, MPH,** *Boston, Massachusetts*

(*J Trauma Acute Care Surg.* 2013;74: 999–1004.

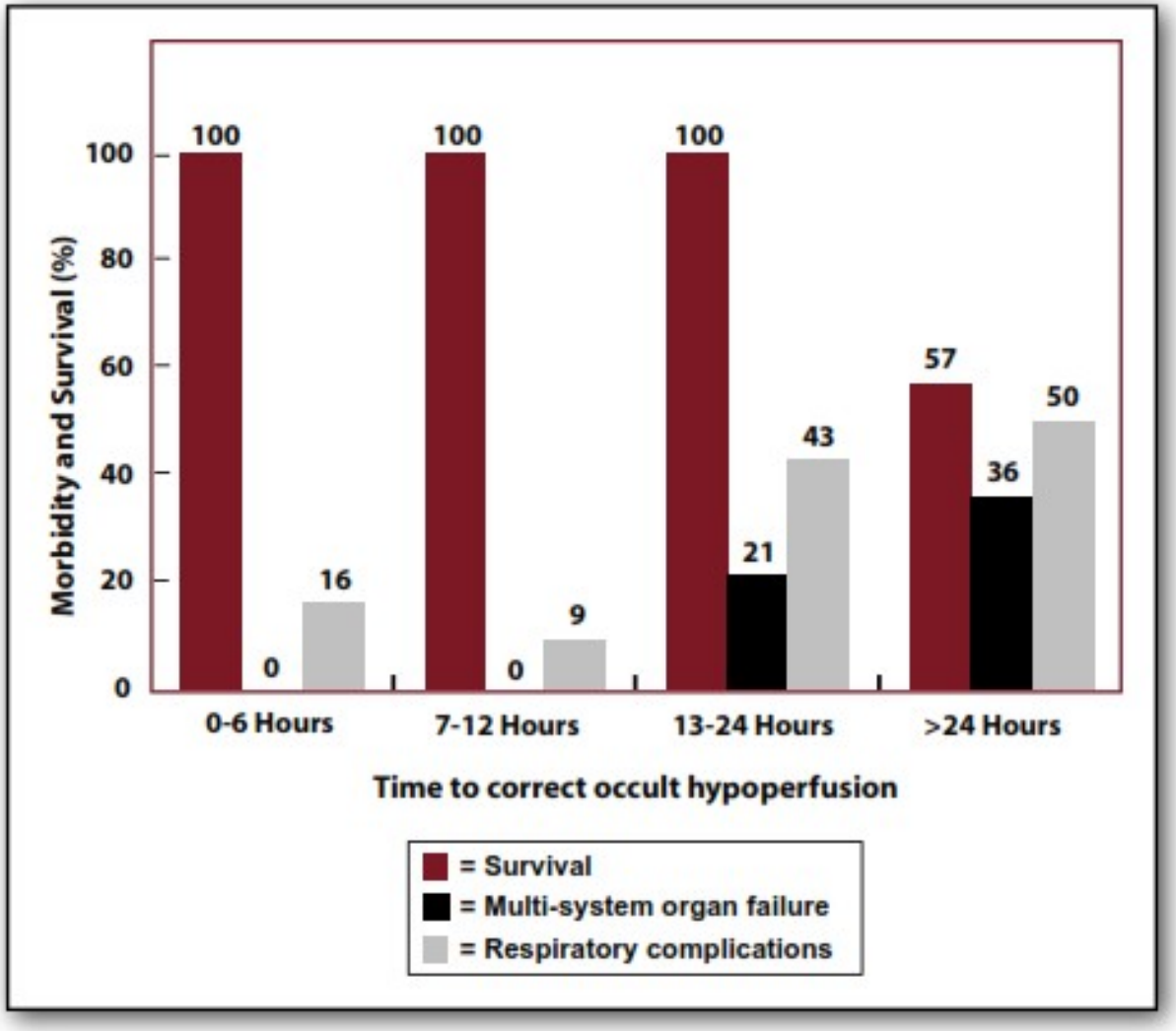
We enrolled 4,742 trauma patients who had an initial lactate measured during a 10-year period.

Initial lactate level was strongly correlated with mortality: when lactate was less than 2.5 mg/dL, 5.4% (95% confidence interval [CI], 4.5–6.2%) of patients died; with lactate 2.5 mg/dL to 4.0 mg/dL, mortality was 6.4% (95% CI, 5.1–7.8%); with lactate 4.0 mg/dL or greater, mortality was 18.8% (95% CI, 15.7–21.9%). After adjustment for age, Injury Severity Score

Both initial lactate and lactate clearance at 6 hours independently predict death in trauma patients.

Laktat Temizlenmesi - 24 st

Altın saat yerine Gümüş Gün



ORIGINAL RESEARCH Open Access

A retrospective analysis of geriatric trauma patients: venous lactate is a better predictor of mortality than traditional vital signs

Kristin M Salottolo[1,2], Charles W Mains[1,3,4], Patrick J Offner[1,3,4], Pamela W Bourg[3] and David Bar-Or[1,2,4*]

Results: There were 1987 geriatric trauma patients included, with an overall mortality of 4.23% and an incidence of occult hypoperfusion of 20.03%. After adjustment for GCS, ISS, and advanced age, venous lactate significantly predicted mortality (OR: 2.62, $p < 0.001$), whereas abnormal TVS (OR: 1.71, $p = 0.21$) and SI ≥ 1 (OR: 1.18, $p = 0.78$) did not. Mortality was significantly greater in patients with occult hypoperfusion compared to patients with no sign of circulatory hemodynamic instability (10.67% versus 3.67%, $p < 0.001$), which continued after adjustment (OR: 2.12, $p = 0.01$).

Conclusions: Our findings demonstrate that occult hypoperfusion was exceedingly common in geriatric trauma patients, and was associated with a two-fold increased odds of mortality. Venous lactate should be measured for all geriatric trauma patients to improve the identification of hemodynamic instability and optimize resuscitative efforts.

454 Serum Lactate Is Not Predictive of Major Injuries in Pediatric Blunt Trauma

Muñiz AE/The University of Texas Health Science Center at Houston, Houston, TX

Study Objectives: The use of serum lactate has been used extensively used in adult patients who suffer from sepsis and in trauma victims as a measure of tissue hypoperfusion in patients who are not demonstrating features of shock on examination. Elevated blood lactate reflect anaerobic metabolism due to hypoperfusion. The purpose of this study was to evaluate the serum lactate in children involved in major trauma and to see if it effectively predicts children with major injuries.

Methods: Prospective study in a university pediatric emergency department. All

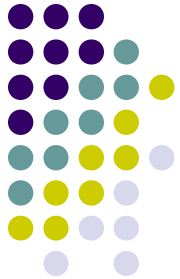
Conclusion: The serum lactate may be a marker for detecting hypoperfusion in adults but is unreliable in predicting major injuries in children who sustained severe blunt trauma.

Results: There were 200 children who met criteria for the study. The average age was 11.8 + 4.7 years-old with a range of 2 to 18 years-old. There were 116 (58%) African Americans, 84 (42%) Caucasians. There were 116 (58%) males. The mechanism of injuries included: motor vehicle crash 152 (26%), hit by a car 24 (12%), falls 12 (6%), bicycle accident 8 (4%), and gun shot wound 4 (2%). There were 102 major injuries in this group. There were 12 (6%), facial fractures 10 (5%) major injuries, 16 (8%) liver lacerations, 10 (5%) spleen lacerations, 16 (8%) pelvic fractures, and 25 (12.5%) extremity fractures. The serum lactate was elevated in 56 (28%). The sensitivity for predicting major injuries was 46.5%, specificity 85.9%, positive predictive value 71.4% and negative predictive value 68%.

Conclusion: The serum lactate may be a marker for detecting hypoperfusion in adults but is unreliable in predicting major injuries in children who sustained severe blunt trauma.

Annals of Emergency Medicine, 2009-09-01, Volume 54, Issue 3, Supplement , Pages S143-S143

Baz Açığı (Base Deficit=Excess)



- 1 lt kan pH'sını 7.4'e getirecek kuvvetli metabolik baz - asit aktivitesi ölçümü (Pco2 = 40 ve 37 C kabul edilir.)
- Normal : - 2 ile 2 mEq/L arası
- Ciddi < - 6 mEq/L

Admission base deficit and lactate levels in Canadian patients with blunt trauma: Are they useful markers of mortality?

Jean-Francois Ouellet, MD, Derek J. Roberts, MD, Corina Tiruta, BSc, Andrew W. Kirkpatrick, MD, Michelle Mercado, Vincent Trottier, MD, Elijah Dixon, MD, David V. Feliciano, MD, *and* **Chad G. Ball, MD,** *Calgary, Canada*

(*J Truama Acute Care Surg.* 2012;72: 1532–1535.

A total of 2,269 patients (76%) had complete data available for analysis. After exclusion of patients who sustained a penetrating injury or were admitted for minor falls (ground levels or low height), 445 had an ABG drawn within 2 hours of arrival. Patients who died displayed a higher median lactate (3.6 vs. 2.2, $p < 0.0001$), a worse median BD (−10 vs. −5, $p < 0.0001$), and a lower pH (7.23 vs. 7.31, $p < 0.0001$) at arrival compared with those of survivors. A statistically significant association was also observed between lactate and BD values at arrival and both mortality and length of stay ($p < 0.0001$).

ABGs at admission in Canadian patients with blunt trauma accurately reflect mortality

a similar manner to the previously published literature. Survival curves with lactate and BD values at arrival should be available to all clinicians within their individual trauma centers for both acute care and quality assurance. (*J Truama Acute*

Admission Base Deficit as a Long-Term Prognostic Factor in Severe Pediatric Trauma Patients

Clémence Hindy-François, MD, Philippe Meyer, MD, Stéphane Blanot, MD, Sophie Marqué, MD, Nada Sabourdin, MD, Pierre Carli, MD, and Gilles Orliaguet, MD, PhD

(*J Trauma*. 2009;67: 1272–1277)

trauma patients. More specifically, an initial serum lactate concentration more than 2.94 mmol/L seems to be an inde-

outcome at 6-month follow-up in 90 consecutive severely traumatized French children.

Serum Lactate and Base Deficit as Predictors of Mortality in Normotensive Elderly Blunt Trauma Patients

David W. Callaway, MD, Nathan I. Shapiro, MD, MPH, Michael W. Donnino, MD, Christopher Baker, MD, and Carlo L. Rosen, MD

J Trauma. 2009;66:1040–1044.

CONCLUSION

Compared with the hospital survival rate of 85% to 86% for elderly normotensive patients with normal blood BD or lactate concentration upon ED arrival, our results indicate a significantly decreased hospital survival rate of 60% associated with blood BD >6 mEq/L or lactate concentration >4 mmol/L upon ED arrival. Future trials should be designed to validate these findings and a prospective trial is needed to delineate the role of lactate and BD as part of a clinical scoring system to identify high-risk elderly blunt trauma patients and guide adequate early resuscitation.

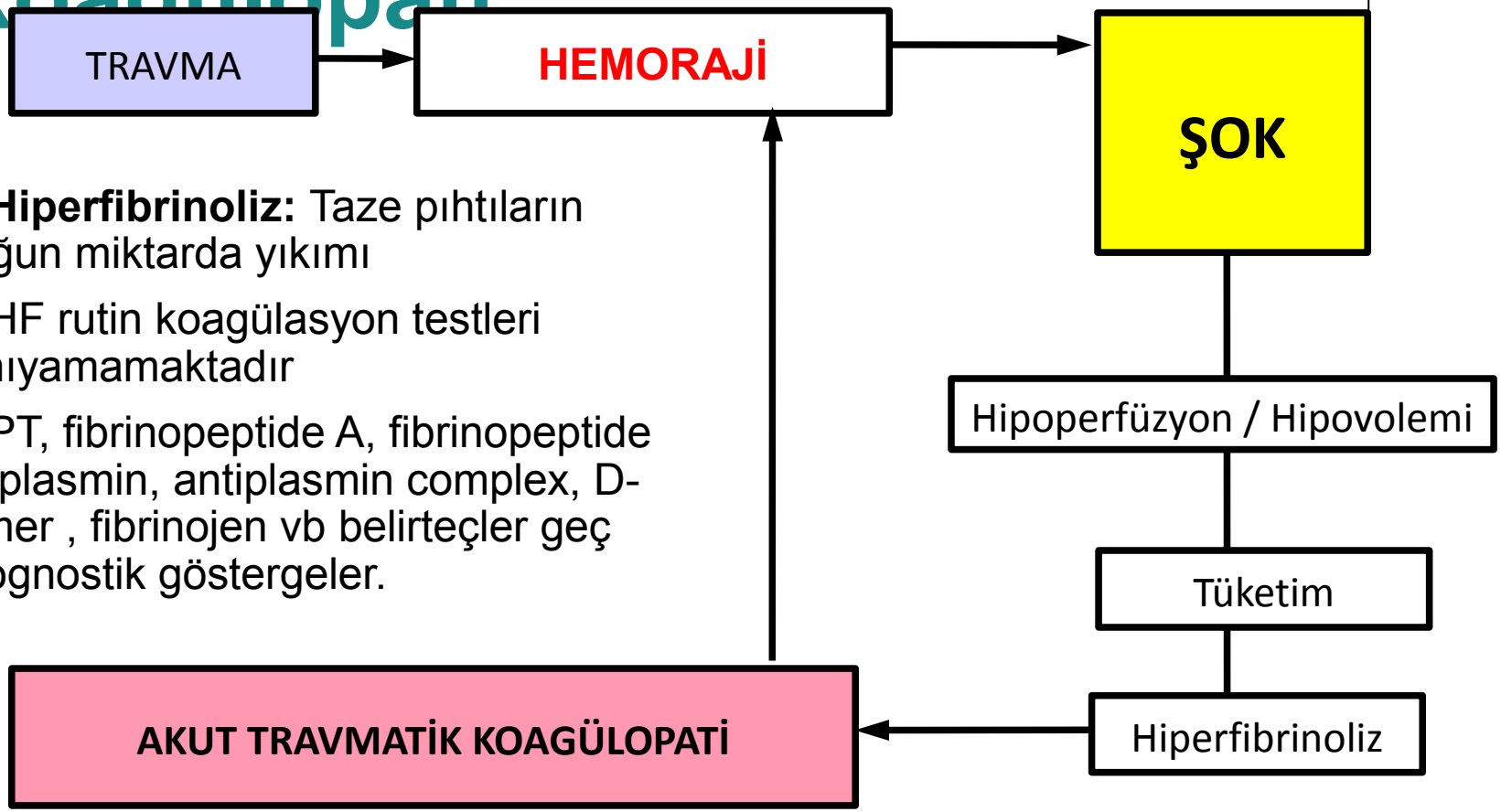
Table 3 Base Deficit and Mortality Rates

Base Deficit (mEq/L)	Total	Total Died	Mortality (%)	95% CI
>0	387	53	13.7	(10.3 to 17.1)
0 to −6	151	41	27.2	(20.1 to 34.2)
<−6	43	17	39.5	(24.9 to 54.1)

Table 2 Lactate and Mortality Rates

Level (mmol/L)	Total	Total Died	Mortality (%)	95% CI
0 to 2.4	428	66	15.4	(12.0 to 18.8)
2.5 to 4.0	107	25	23.4	(15.3 to 32.4)
>4.0	53	21	39.6	(26.5 to 52.8)

Çoklu Travma ve Koagülopati

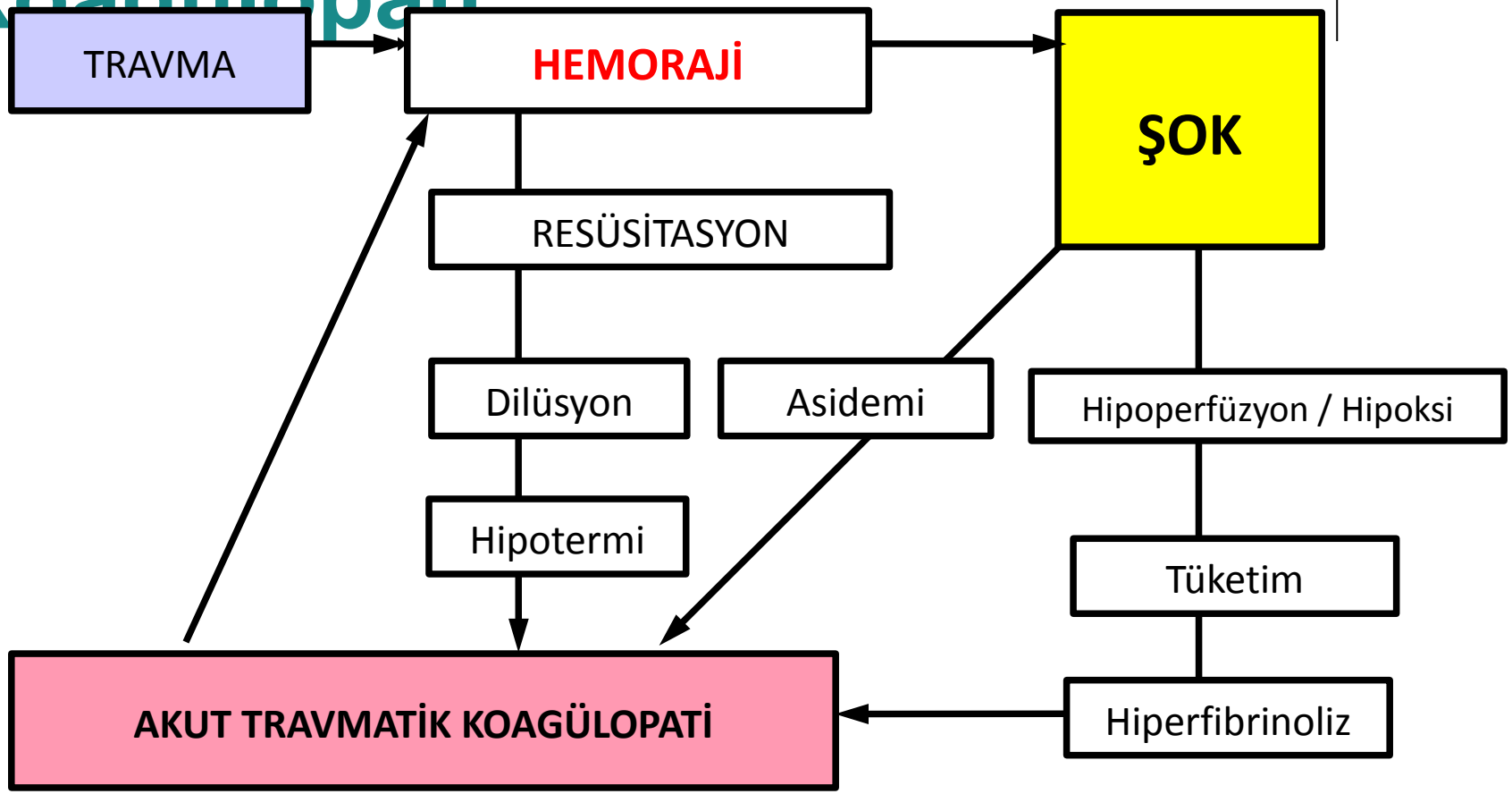


·**Hiperfibrinoliz:** Taze pıhtıların yoğun miktarda yıkımı

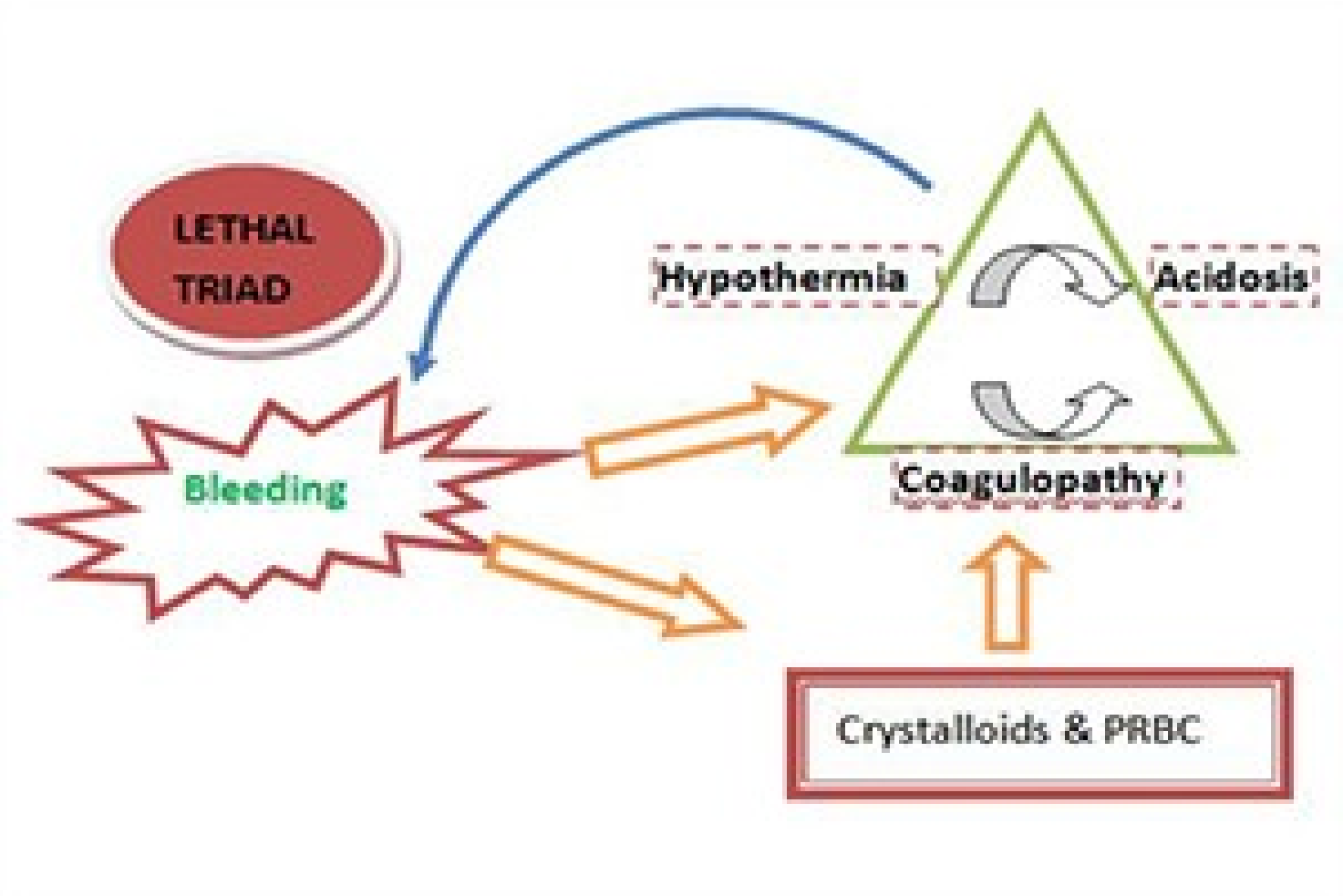
·HF rutin koagülasyon testleri tanıyamamaktadır

·PT, fibrinopeptide A, fibrinopeptide B, plasmin, antiplasmin complex, D-dimer , fibrinojen vb belirteçler geç prognostik göstergeler.

Çoklu Travma ve Koagülopati



Ölümcül Üçlü



Hyperfibrinolysis After Major Trauma: Differential Diagnosis of Lysis Patterns and Prognostic Value of Thrombelastometry

(*J Trauma.* 2009;67: 125–131)

Herbert Schöchl, MD, Thomas Frietsch, MD, Michaela Pavelka, MD, and Csilla Jámbor, MD

ROTEM analysis is routinely performed as a part of coagulation monitoring for all trauma alarms that request the full trauma team in the emergency room (ER). Between January 2003 and December 2007, all trauma patients with

In conclusion, HF occurs in major trauma and is a predictor of poor outcome. Monitoring with thrombelastometry allows early diagnosis of HF and differentiation of benign forms from severe refractory forms with 100% mortality.

TABLE 3. Laboratory and ROTEM Results of Patients With Hyperfibrinolysis

	Survivors	Nonsurvivors	*p*
Hb (g/dL)	9.7 ± 2.7	7.5 ± 2.9	0.178
Hematocrit (%)	29.2 ± 8.0	22.9 ± 8.0	0.175
Platelets (/nL)	193 ± 91	123 ± 53	0.034
Fibrinogen (mg/dL)	110.0 ± 29.8	75.1 ± 39.8	0.107
CFT_{INTEM} (s)	82 (14/190)	359 (140/632)	0.042
$MCF_{EX} - MCF_{FIB}$ (mm)	46 (40/53)	34 (20/40)	0.026

Prognostik Belirteçlerin G

The pulse pressure/heart rate ratio as a marker of stroke volume changes during hemorrhagic shock and resuscitation in anesthetized swine

Julien Pottecher, MD, PhD, Denis Chemla, MD, PhD, Lorenço Xavier, MD, Ngai Liu, MD, PhD, Thierry Chazot, MD, Jacques Marescaux, MD, PhD, Marc Fischler, MD, Pierre Diemunsch, MD, PhD, *and* Jacques Duranteau, MD, PhD, *Strasbourg, France*

(*J Trauma Acute Care Surg*. 2013;74: 1438–1445.

Nabız Basıncı / Kalp Hızı oranı kanama sonucu meydana gelen Atım Hacmi (Stroke Volume) tespitinde aşağıdakilerden daha duyarlı

- Nabız
- Sistolik Kan Basıncı
- Diastolik Kan Basıncı
- Şok indeksi
- Ortalama Kan Basıncı

SHOCK, Vol. 38, No. 6, pp. 635–641, 2012

A NEW SEVERITY PREDICTING INDEX FOR HEMORRHAGIC SHOCK USING LACTATE CONCENTRATION AND PERIPHERAL PERFUSION IN A RAT MODEL

Joon Yul Choi,*† Wan Hyung Lee,‡ Tae Keun Yoo,‡ Incheol Park,§ and Deok Won Kim*†‡

*Department of Medical Engineering; †Brain Korea 21 Project for Medical Science; and Departments of ‡Medicine and §Emergency Medicine, Yonsei University College of Medicine, Seoul, South Korea

ABSTRACT—Forty percent of trauma deaths are due to hemorrhage, with 33% to 56% occurring in the prehospital environment. This study proposes a new index (NI) based on the ratio of serum lactate concentration (LC) to peripheral perfusion (PP) as an indicator of hemorrhage-induced mortality during the prehospital stage. Thirty-six anesthetized rats were randomized into three groups according to volume of controlled blood loss. We measured heart rate (HR), systolic and diastolic blood pressures (SBP and DBP), mean arterial pressure (MAP), pulse pressure (PPR), respiration rate (RR), temperature (TEMP), LC, PP, shock index (SI = HR/SBP), and proposed the new hemorrhage-induced mortality index (NI = LC/PP). Peripheral perfusion, defined as peripheral tissue perfusion and skin microcirculation, was continuously monitored by laser Doppler flowmetry. All parameters were analyzed for changes between prehemorrhage and posthemorrhage to investigate the effects of hemorrhage on mortality. Areas under a receiver operating characteristic curve (AUCs) in descending order for NI, SI, PP, SBP, MAP, PPR, DBP, TEMP, LC, RR, and HR were 0.975, 0.941, 0.922, 0.919, 0.903, 0.884, 0.847, 0.816, 0.783, 0.744, and 0.672, respectively. The correlation coefficients with mortality for NI, SI, PP, SBP, MAP, PPR, DBP, TEMP, LC, RR, and HR were -0.818, -0.759, 0.726, 0.721, 0.694, 0.662, 0.597, 0.544, -0.487, 0.420, and -0.296, respectively, with the same order as the AUC. NI was shown to be an optimal independent mortality predictor on multivariable logistic regression analysis. In conclusion, the newly proposed hemorrhage-induced mortality index, based on blood lactate/PP ratio, was a better marker for predicting mortality in rats undergoing acute hemorrhage in comparison to the other parameters evaluated in this study.