



# 严重创伤大出血的早期处理

——2013严重创伤出血和凝血病处理的欧洲指南

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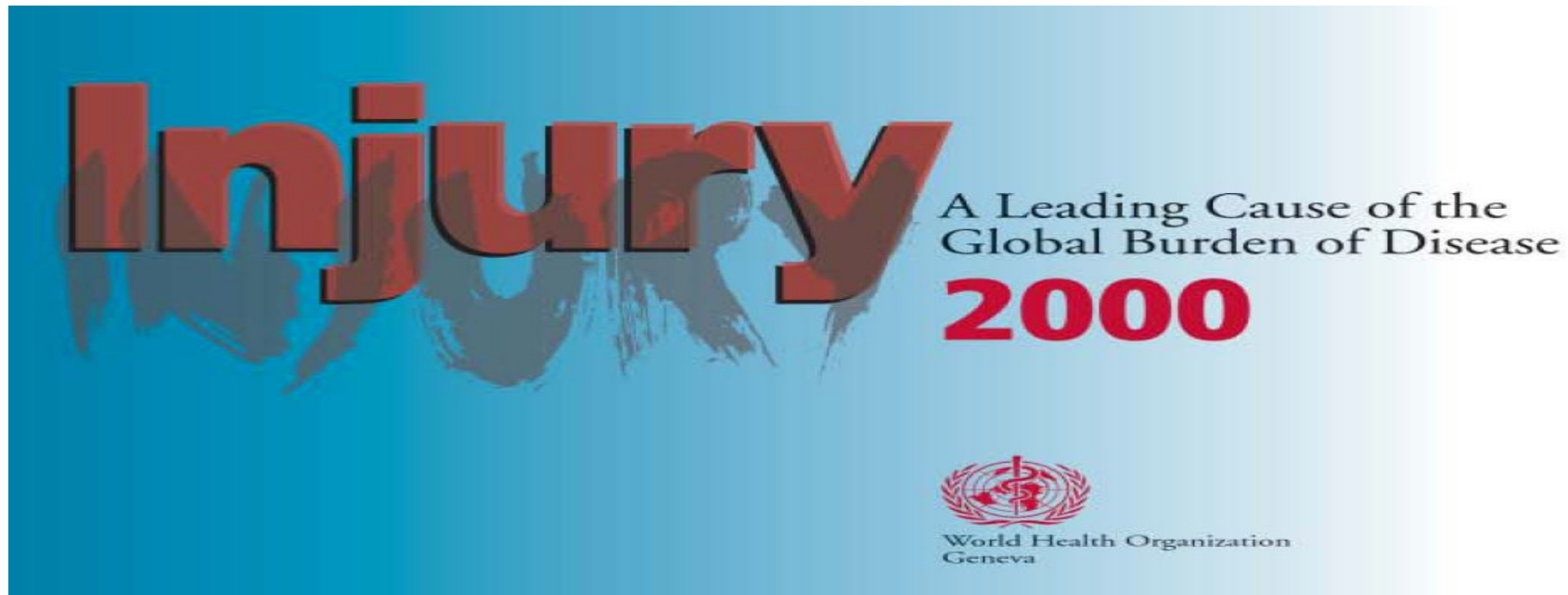




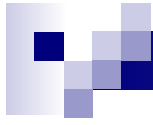
# 一、背景



创伤是当今世界面临的一个普遍问题！



2000年全球死于创伤的人数约500万，占全球死亡总数的9%。



## 创伤死亡的三大主要原因



*其中，未控制的创伤后大出血是可预防死亡的首要原因！*





## Review

# Patterns of mortality and causes of death in polytrauma patients—Has anything changed?

Roman Pfeifer<sup>a,\*</sup>, Ivan S. Tarkin<sup>a</sup>, Brett Rocos<sup>b</sup>, Hans-Christoph Pape<sup>a</sup>

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<sup>b</sup> Department of Trauma and Orthopaedics, Bristol Royal Infirmary University Hospitals, Bristol, UK

Causes of death of multiple trauma patients.

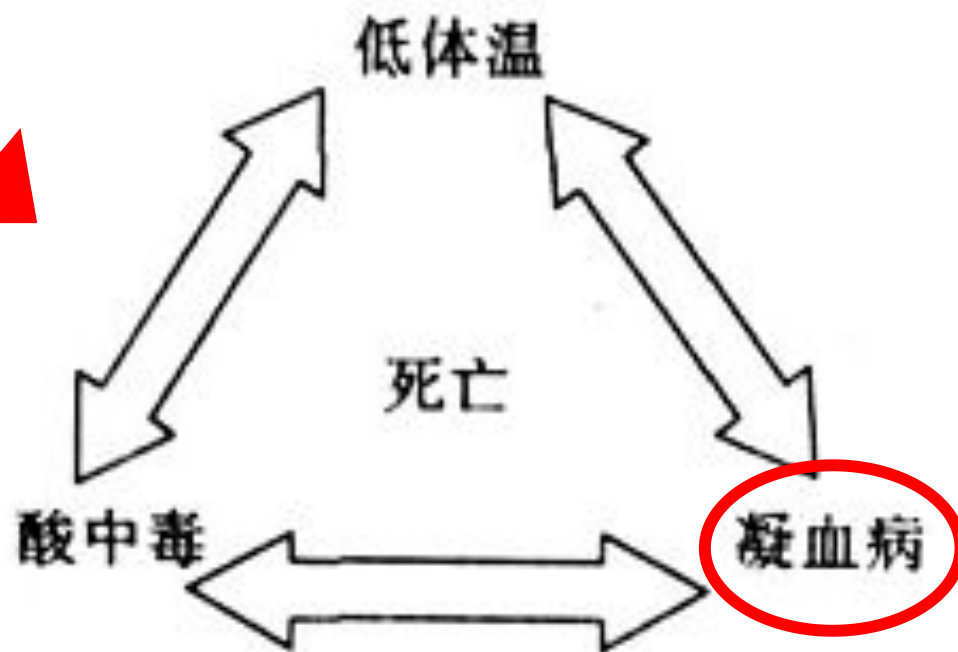
References	Pat. No.	Causes of death				
		Sepsis	Haemorrhage	MOF	Respir failure	Brain injury
Baker et al. <sup>2</sup>	437	9.8%	31.2%	NS	NS	50.1%
Coris et al. <sup>23,a</sup>	89	NS	18%	NS	4%	57%
Pories et al. <sup>46</sup>	54	NS	24%	NS	NS	50%
Shackford et al. <sup>55</sup>	104	4.8%	35%	NS	NS	48%
Sahdev et al. <sup>52</sup>	177	6%	25%	NS	NS	60%
Esposito et al. <sup>20,b</sup>	324	2%	20%	NS	8%	42%
Sauaia et al. <sup>54</sup>	289	NS	39%	7%	NS	42%
Maio et al. <sup>36,b</sup>	155	1.3%	20%	NS	1.9%	36.1%
Meislin et al. <sup>38,a</sup>	710	3%	31%	10%	6%	46%
Hodgson et al. <sup>27</sup>	108	17%	15%	9%	6%	27%
Marson et al. <sup>37</sup>	115	3.1–5.2	12.5–13.9%	NS	NS	67–70.3%
Chiara et al. <sup>14</sup>	255	NS	26.6%	1.9%	NS	21.6%
Stewart et al. <sup>60</sup>	753	NS	21%	9%	NS	51%
Tien et al. <sup>61</sup>	558	NS	15%	5%	NS	60%
Soreide et al. <sup>57</sup>	260	NS	25%	8%	NS	67%
Pang et al. <sup>42</sup>	186	NS	15.6%	1.6%	3.8%	71.5%
Median (range) 1980s		7.3% [4.8–9.8]	27.6% [18–35]		4.0%	50.1% [48–57]
Median (range) 1990s		3.0% [1.3–6]	25.0% [20–39]	8.7% [7–10]	7.0% [1.9–8]	44.2% [36.1–42]
Median (range) 2000s		5.2% [3.1–17]	15.0% [12.5–26.6]	6.5% [1.6–9]	4.9% [3.8–6]	63.5% [21.6–71.5]

*Injury*, 2009, 40(9):907–911.



创伤大出血

死亡三联征



# 严重创伤后的凝血功能障碍非常普遍！

**Table 1** Basic characteristics of patients with and without coagulopathy upon ER admission and main differences between both groups ( $n = 8724$ )

$n$	Coagulopathy + 2989 (34.2%)	Coagulopathy – 5735 (65.8%)	$p$ -Value
Mean age (years $\pm$ S.D.)	37 $\pm$ 19	40 $\pm$ 19	<0.001
Male/female (%)	72.5/27.5	73.1/26.9	0.55 (n.s.)
Blunt/penetrating trauma (%)	96/4	96/4	0.95 (n.s.)
Time injury > ER (min $\pm$ S.D.)	74 $\pm$ 31	66 $\pm$ 30	<0.001
Pre-clinical CPR (%)	4.3	1.0	<0.001
ISS (mean $\pm$ S.D. in points)	30 $\pm$ 15	21 $\pm$ 12	<0.001
ISS $\geq$ 16 (%)	84	66	<0.001
AIS head $\geq$ 3 (%)	48	41	<0.001
AIS thorax $\geq$ 3 (%)	59	40	<0.001
AIS abdomen $\geq$ 3 (%)	30	15	<0.001
AIS extremities $\geq$ 3 (%)	54	34	<0.001
i.v. fluids pre-clinically (ml $\pm$ S.D.)	2198 $\pm$ 1402	1372 $\pm$ 931	<0.001
Mechanical ventilation (days $\pm$ S.D.)	10 $\pm$ 14	6.5 $\pm$ 11	<0.001
ICU stay (days $\pm$ S.D.)	15 $\pm$ 19	11 $\pm$ 14	<0.001
In-hospital stay (overall in days $\pm$ S.D.)	33 $\pm$ 36	26 $\pm$ 27	<0.001
MOF (%)	29	12	<0.001
Early in-hospital mortality < 24 h (%)	13	1.5	<0.001
In-hospital mortality (overall in %)	28	8.4	<0.001

*Abbreviations:* AIS, abbreviated injury scale; CPR, cardiopulmonary reanimation; ER, emergency room; ICU, intensive care unit; ISS, injury severity score; i.v., intravenous; MOF, multi-organ failure; S.D., standard deviation.

## 创伤性凝血病对预后有着重要的影响

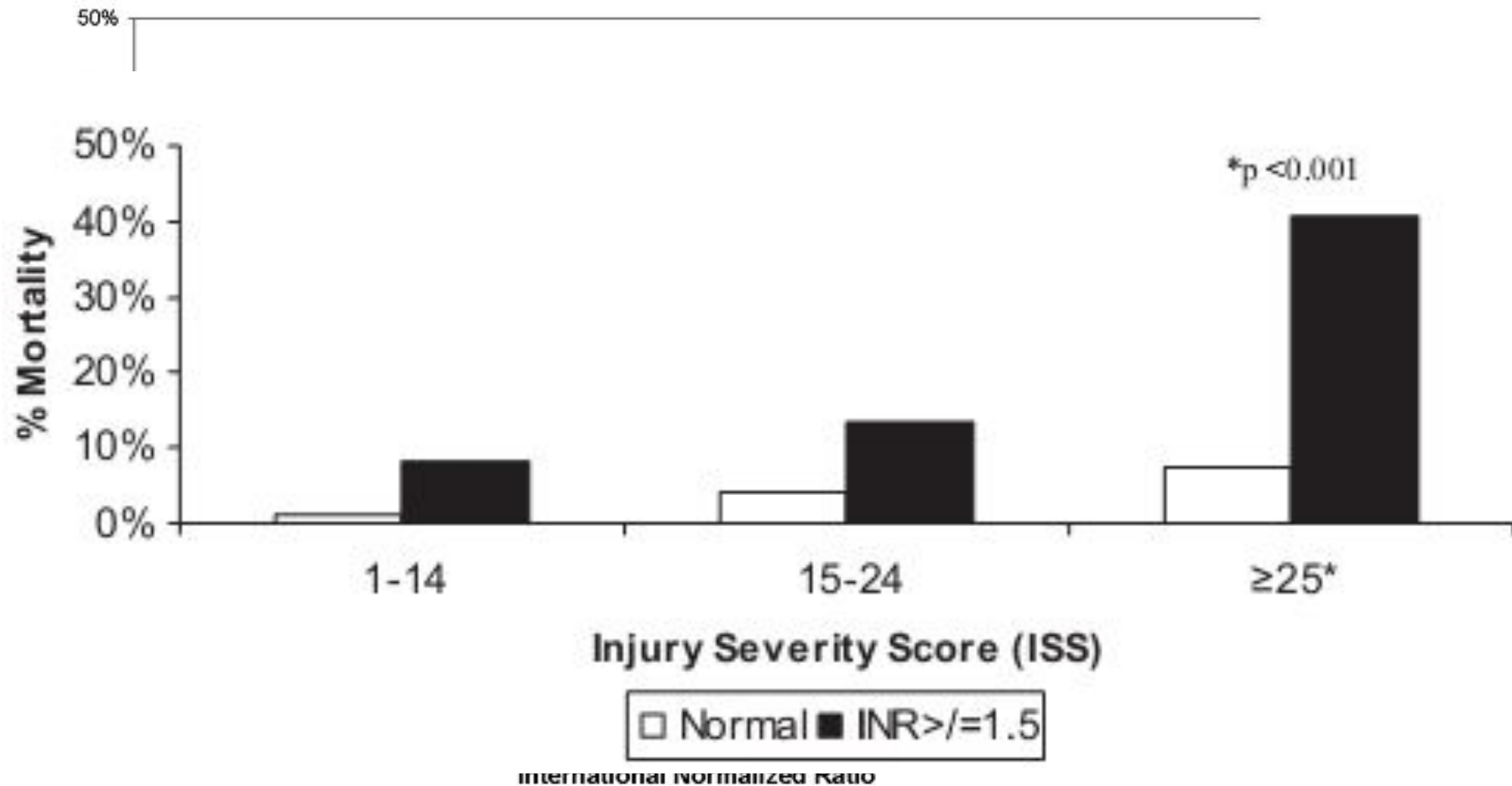
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## 入院时有凝血功能异常的创伤患者死亡率增加4~6倍



Niles SE, et al. *J Trauma*, 2008, 64(6): 1459-1463.





# 严重创伤大出血处理的欧洲指南

中华急诊医学杂志 2013 年 8 月第 22 卷第 8 期 Chin J Emerg Med, August 2013, Vol. 22, No. 8

## 严重创伤出血和凝血病处理欧洲指南（2013 版）

江利冰 张茂 马岳峰 编译 *Critical Care*, 2013, 17 (2): R76

未控制的出血是严重创伤患者潜在可预防的首位死因。恰当的处理包括早期明确出血部位，采取积极的措施减少失血量，恢复组织灌注和稳定血流动力学。大约有1/3的创伤出血患者入院时存在凝血功能障碍，显著增加了病死率和多器官功能衰竭的发生率。创伤出血高级处理特别工作小组（Task Force for Advanced Bleeding Care in Trauma）于2007年发布严重创伤出血处理的指南，2010年进行更新，2013年再次进行更新，并作为欧洲“止血运动（STOP the Bleeding Campaign）”的内容。

型、损伤机制以及患者对初始复苏的反应，综合评估患者出血的程度。（1C）

（2）对于明确出血部位的失血性休克患者，如果初始的复苏无效，则应立即采取控制出血的措施。（1B）

（3）对于未明确出血部位的失血性休克患者，推荐立即采取进一步的评估。（1B）

（4）对于怀疑有躯干部损伤的患者，推荐早期进行影像学检查（FAST 或 CT）以明确有无胸腹腔游离液体。（1B）



## ***STOP the Bleeding Campaign —2013***

- **S**earch for patients at risk of coagulopathic bleeding
- **T**reat bleeding and coagulopathy as soon as they develop
- **O**bserve the response to interventions
- **P**revent secondary bleeding and coagulopathy



# 严重创伤大出血规范处理的内容

*I. Initial resuscitation and prevention of further bleeding*



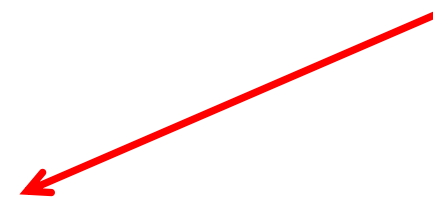
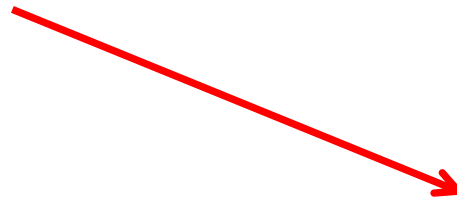
**II. Diagnosis and monitoring of bleeding**



**III. Tissue oxygenation  
fluid and hypothermia**

**IV. Rapid control of  
bleeding**

**V. Management of bleeding  
and coagulation**



**VI. Treatment pathway**





## 二、早期复苏和防止进一步出血



- **R1:** 对于需要紧急外科手术止血的患者，应尽量缩短受伤至手术的时间（**1A**）
- **R2:** 开放性四肢损伤存在威胁生命的大出血，在外科手术前推荐使用止血带（**1B**）
- **R3:** 对于没有脑疝征象的创伤患者，推荐开始机械通气时采用正常的通气量(**1C**)



## 超过50%的创伤死亡发生在伤后24h内

**Table 3** Timing of death following injury, sub-classified by mechanism

Deaths	Immediate (< 24 h)		Early (2–7 days)		Late (> 7 days)	
	Total no. patients	Mechanism of injury	Total no. patients	Mechanism of injury	Total no. patients	Mechanism of injury
1992 ( <i>n</i> = 398)	260 (65%)	T = 95	33 (8%)	T = 10	59 (15%)	T = 18
		F = 12		F = 13		F = 22
		I = 136		I = 5		I = 14
		O = 17		O = 5		O = 5
2002 ( <i>n</i> = 420)	228 (54%)	T = 104	66 (16%)	T = 17	74 (18%)	T = 35
		F = 22		F = 36		F = 28
		I = 87		I = 12		I = 5
		O = 15		O = 1		O = 6

*T* transport-related; *F* fall; *I* intentional injury; *O* other/unknown mechanisms

## 止血帶是控制大出血最简单有效的措施

Western Trauma Association Critical Decisions in Trauma:  
Management of the mangled extremity



*J Trauma.* 2012;72: 86–93.



## 院前使用止血帶可以有效控制出血



**Conclusions:** Prehospital tourniquet use was associated with improved hemorrhage control, particularly in the worse injured (Injury Severity Score >15) subset of patients. Fifty-seven percent of the deaths might have been prevented by earlier tourniquet use. There were no early adverse outcomes related to tourniquet use.

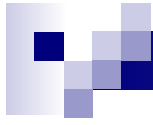


## 伴有出血的TBI不宜过度通气的机制

- 减少静脉回流，导致低血压、心血管衰竭
- 谷氨酸的释放，神经功能损伤
- 低碳酸血症，细胞凋亡，加重原有损伤



### 三、诊断和监测出血



**R4:** 临床医生应根据患者的生理指标、损伤的解剖类型、损伤机制以及患者对初始复苏的反应，综合评估患者出血的程度(1C)

**R5:** 对于明确出血部位的失血性休克患者，如果初始的复苏无效，应立即采取控制出血的措施(1B)

**R6:** 对于未明确出血部位的失血性休克患者，推荐立即采取进一步的评估(1B)





- **R4:**临床医生应根据患者的生理指标、损伤的解剖类型、损伤机制以及患者对初始复苏的反应，综合评估患者出血的程度(1C)

**Table 3. American College of Surgeons Advanced Trauma Life Support (ATLS) responses to initial fluid resuscitation.**

	<b>Rapid response</b>	<b>Transient response</b>	<b>Minimal or no response</b>
- Vital signs	Return to normal	Transient improvement, recurrence of decreased blood pressure and increased heart rate	Remain abnormal
- Estimated blood loss	Minimal (10%-20%)	Moderate and ongoing (20%-40%)	Severe (>40%)
Need for more crystalloid	Low	Low to moderate	Moderate as bridge to transfusion
Need for blood	Low	Moderate to high	Immediate
Blood preparation	Type and crossmatch	Type-specific	Emergency blood release
Need for operative intervention	Possibly	Likely	Highly likely
Early presence of surgeon	Yes	Yes	Yes

- Table reprinted with permission from the American College of Surgeons [57]. \*Isotonic crystalloid solution, 2000 ml in adults; 20 ml/kg in children.



## **Abdominal vascular trauma: a review of 106 injuries.**

Jackson MR, Olson DW, Beckett WC Jr, Olsen SB, Robertson FM.

Department of Surgery, Joint Military Medical Command, San Antonio, Texas.

### **Abstract**

A retrospective analysis of acute abdominal vascular injuries was performed to review outcome variables and treatment principles. The authors review their most recent 5-year experience with 106 major abdominal vascular injuries in 64 patients treated at a combined Army and Air Force urban medical center. The majority of the patients were young men who sustained penetrating injuries. There were 41 (64%) gunshot wounds, 17 (27%) stab wounds, and 6 (9%) sustained blunt trauma. Forty-five patients (71%) came to the hospital in shock. The inferior vena cava in 26 patients (41%) and the aorta in 11 patients (17%) were injured most frequently. Suture repair was possible in 53 (50%) injuries. Ligation was performed in 41 (39%). Overall mortality for the series was 39 per cent. Hemorrhagic shock was the cause of death in 23 patients (92%) with only two late deaths. Transfusion requirement, presence of shock, and number of vessels injured all affected outcome. Immediate stabilization in the emergency department includes appropriate crystalloid and blood product resuscitation with minimal delay for diagnostic studies. Prompt abdominal exploration to control hemorrhage and particular attention to factors associated with coagulopathy remain the key elements in saving the lives of these severely injured patients.

***Am Surg. 1992 Oct;58(10):622-6.***

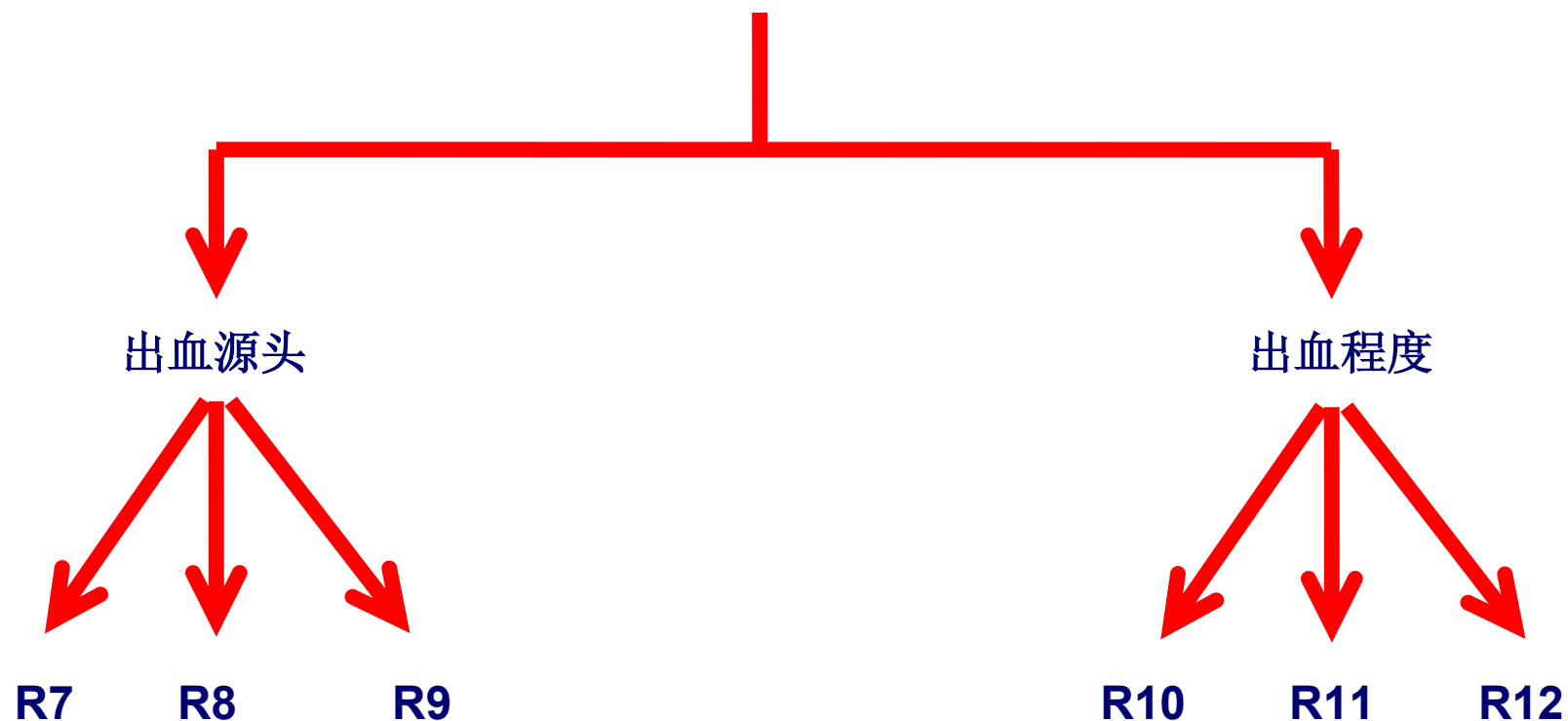
## **The Importance of Fracture Pattern in Guiding Therapeutic Decision-Making in Patients with Hemorrhagic Shock and Pelvic Ring Disruptions**

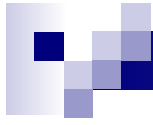
*Brian J. Eastridge, MD, Adam Starr, MD, Joseph P. Minei, MD, and Grant E. O'Keefe, MD*

***J Trauma. 2002;53:446 –451***



**R6:**对于未明确出血部位的失血性休克患者，推荐  
立即采取进一步的评估**(1B)**





## 明确出血的源头

### *Imaging*

**R7:** 对于怀疑有躯干部损伤的患者，推荐早期进行影像学检查（FAST/CT）  
以明确有无胸腹腔游离液体（1B）

### *Intervention*

**R8:** 对于存在明显腹腔积液而血流动力学不稳定的患者，应采取紧急的干预措施（1A）

### *Further assessment*

**R9:** 对于血流动力学稳定的患者，推荐使用CT进行进一步的评估（1B）



## *FAST*评估对严重创伤有较好的诊断价值

Study	No. of subjects	Sensitivity (%)	Specificity (%)	NPV (%)
Our study	242	86	99	98
Nural (2005) [25]	454	86.5	95.4	98.7
Holmes (2004) [26]	447	79	95	93
Miller (2003) [27]	359	42	98	93
Matthew (2001) [15]	2,576	86	98	98
Mckenney (2001) [20]	996	88	99	98
Coley (2000) [28]	107	55	83	50
Boulanger (1999) [21]	400	81	97	96
Shackford (1999) [10]	234	69	98	98
Chiu (1997) [14]	772	71	100	78





## *FAST 评估缩短术前和住院时间，减少CT检查、并发症和费用*

OR Patients Only	PLUS (N=29) <sup>†</sup>	Control (N=34)
Age, y	23 [20, 21, 22]	22 [18, 22, 24]
Sex, female, %	26	29
Revised trauma score (0–7.8)	6.8 [6.7, 7.5, 7.8]	6.7 [6.6, 7.5, 7.8]
Injury Severity Score (0–75)	22 [17, 22, 29]	21 [15, 18, 26]
Glasgow Coma Scale score (0–15)	12 [10, 14, 15]	12 [10, 13, 15]
Torso trauma (%)	86±9	84±9
Time from ED arrival to OR transfer, min	57 [41, 60, 70]	166 [90, 157, 178]

Subgroups	PLUS	Control	Multiplicative Changes or Odds Ratios With 95% CIs Associated With PLUS
<b>All patients</b>	(N=111)	(N=106)	
CT done (%)	53 [44, 62]	85 [76, 92]	Odds ratio=0.16 [0.07, 0.31]
Total charges, \$	16,100 [5,700, 10,600, 19,000]	31,500 [6,700, 16,400, 43,600]	Multiplicative change=0.65 [0.52, 0.81]
<b>Admitted patients only</b>	(N=92)	(N=83)	
Hosp-LOS, days	6.2 [1.0, 4.0, 8.0]	10.2 [2.0, 5.0, 12.0]	Multiplicative change=0.73 [0.54, 0.99]
<b>OR patients only</b>	(N=29)	(N=34)	
CT done (%)	25 [10,47]	78 [56, 93]	Odds ratio=0.07 [0.01, 0.29]
Hosp-LOS, days	10.7 [4.0, 8.0, 22]	15.1 [5.0, 12.0, 23.6]	Multiplicative change=0.40 [0.16, 1.00]
Composite complications, %*	21 [11, 27]	38 [28, 46]	Odds ratio=0.17 [0.02, 0.86]
Total charges, \$	28,400 [15,100, 22,600, 37,100]	47,600 [29,500, 43,800, 55,700]	Multiplicative change=0.90 [0.54, 1.48]

*Lawrence AM. Ann Emerg Med,2006,48:227-235.*



## REVIEW ARTICLE

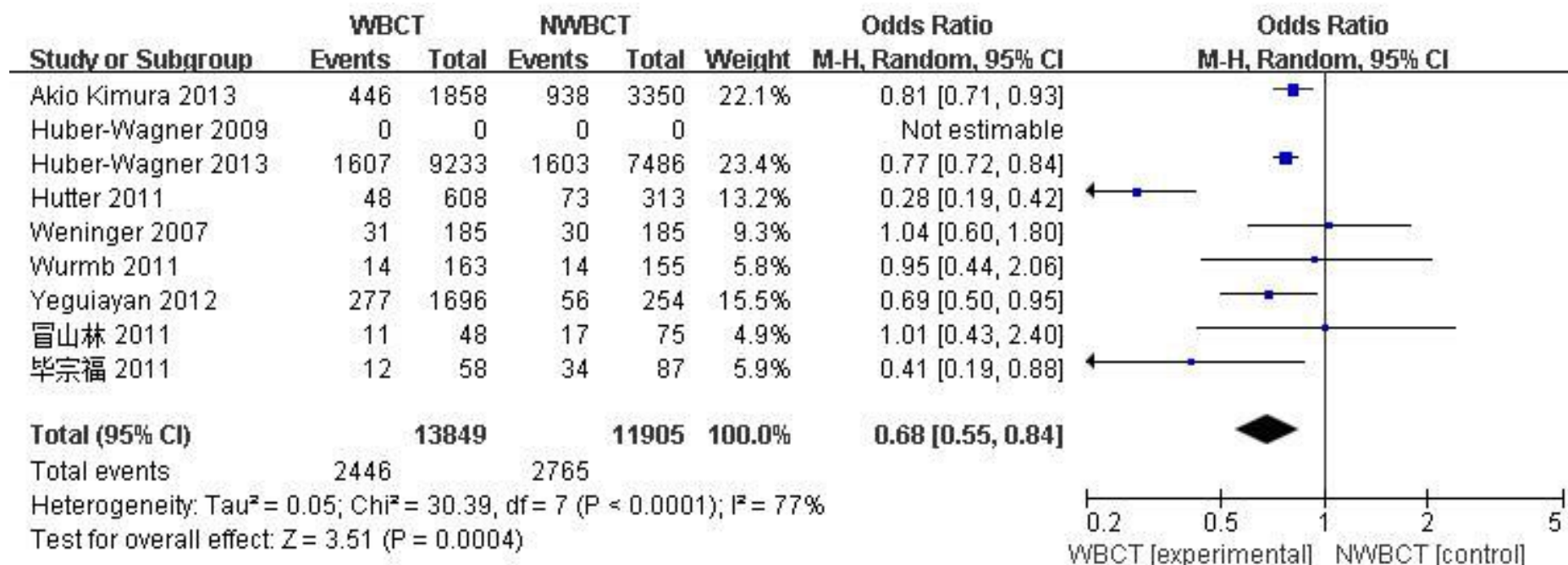
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### Effects on mortality, treatment, and time management as a result of routine use of total body computed tomography in blunt high-energy trauma patients

Routine TBCT gives a change of treatment in 2% to 27% of the patients and it improves time intervals in the ED as compared with its selective use. Current literature has predominantly suboptimal designs to prove terminally that the routine use of TBCT results in an improved survival of blunt high-energy trauma patients.



## WBCT对创伤患者病死率的影响







## 出血程度的评估

- **R10:** 不推荐单独使用红细胞（Hct）检测作为评估出血程度的独立实验室指标（1B)
- **R11:** 推荐检测血清乳酸或碱剩余作为评估、检测出血和休克程度的敏感指标（1B)
- **R12:** 推荐常规评估创伤后的凝血病，包括早期、重复、和联合检测凝血酶原时间（PT）、部分凝血活酶时间（APTT）、纤维蛋白原和血小板（1C）。推荐使用血栓弹力图帮助明确凝血病的特征和指导止血治疗（1C）。



- **R10: 不推荐单独使用红细胞（Hct）检测作为评估出血程度的独立实验室指标（1B）**
  - 容易受到复苏策略的影响（静脉输注液体或浓缩红细胞）
  - 失血早期患者Hct可保持正常（代偿需要时间）

### **Significance of the initial spun hematocrit in trauma patients.**

Snyder HS.

Department of Emergency Medicine, Albany Medical College, NY 12208, USA.

#### **Abstract**

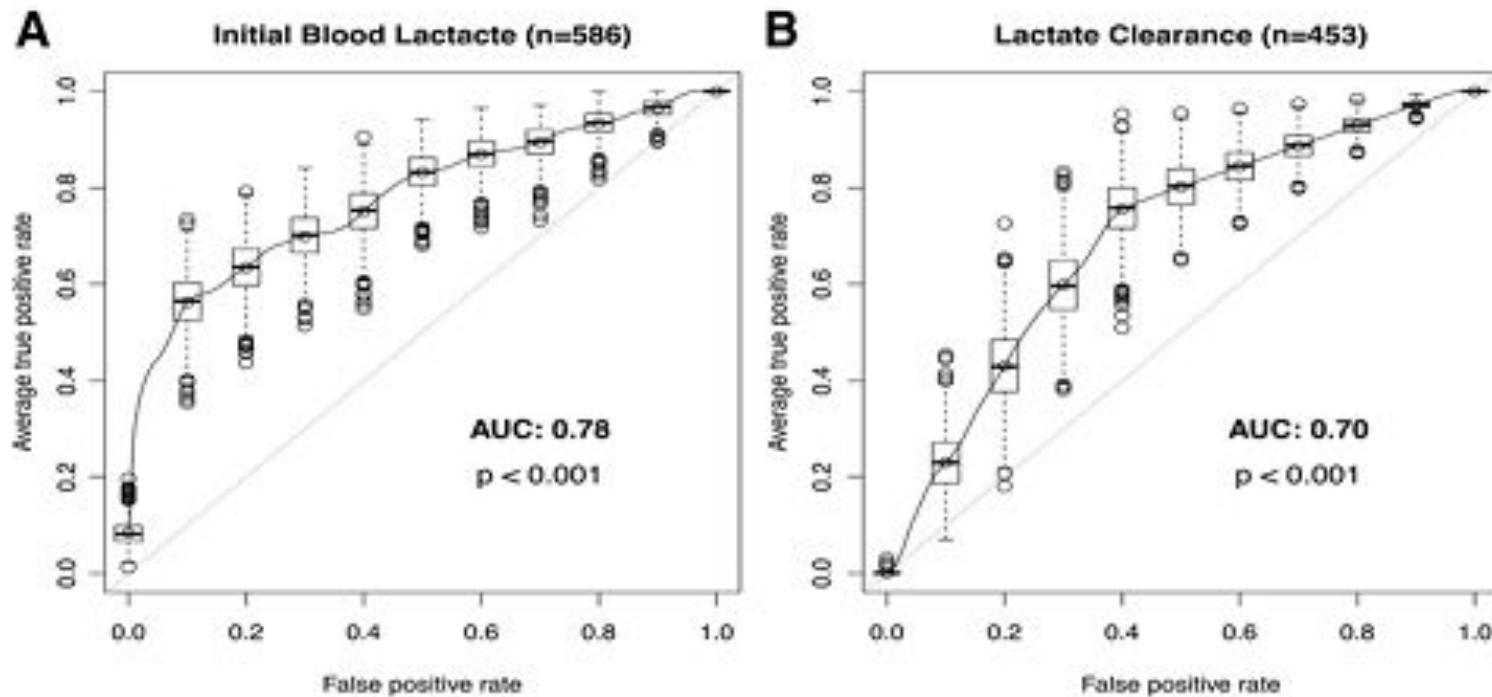
This study was designed to determine whether the initial spun hematocrit (HCT) value correlated with blood loss requiring operative intervention (OR). A spun HCT was performed on the first available blood sample from 524 admitted patients 12 years of age or older with traumatic injuries (86% blunt, 14% penetrating). Patients in the OR (n = 66) group had a lower mean HCT (35 v 41,  $P < .001$ ) when compared with the non-OR group. The 81 patients with an HCT of  $\leq 35$  required OR more frequently (41% v 7%,  $P < .001$ ). An HCT of  $\leq 35$  had a sensitivity of 50%, specificity of 90%, positive predictive value of 41%, and negative predictive value of 93% for identifying the OR group. The effect of hemodilution from intravenous fluid is difficult to assess in a retrospective clinical study.

***Am J Emerg Med. 1998 Mar;16(2):150-3***

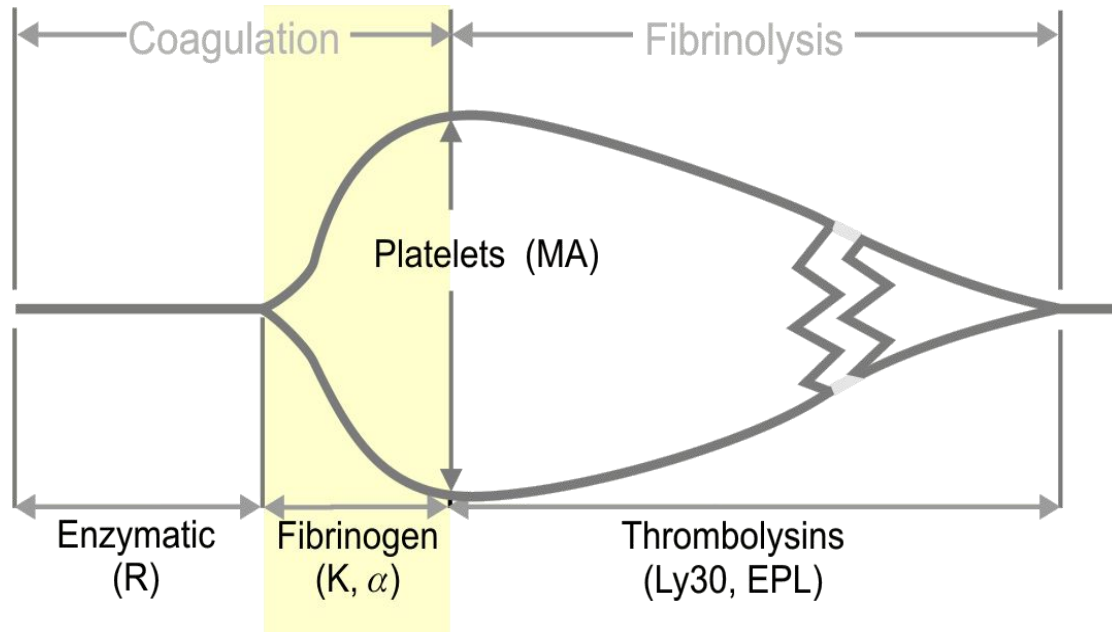


- **R11: 推荐检测血清乳酸或碱剩余作为评估、检测出血和休克程度的敏感指标 (1B)**

## Prognostic Significance of Blood Lactate and Lactate Clearance in Trauma Patients



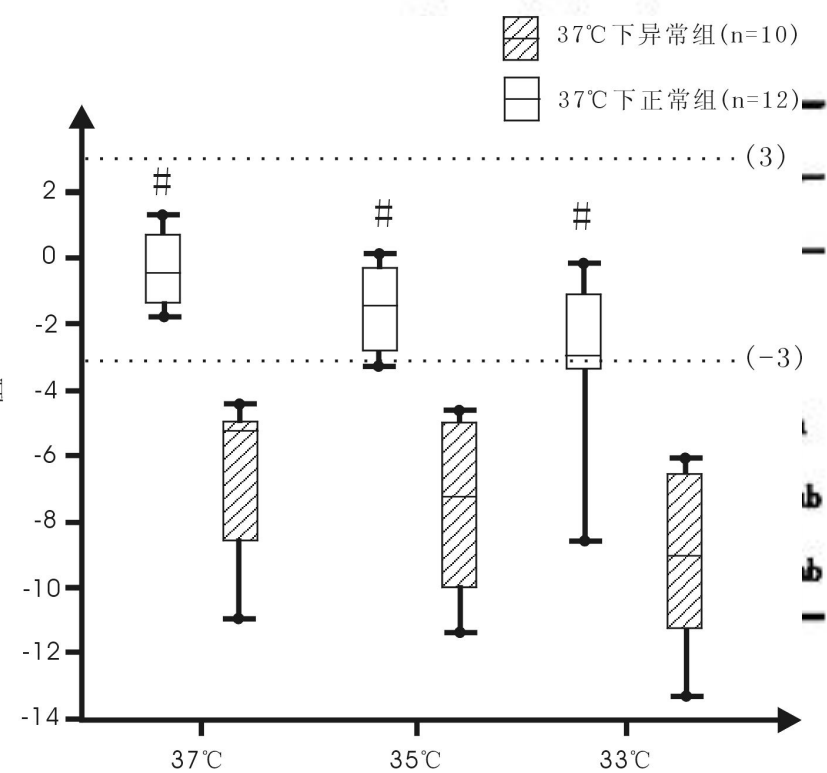
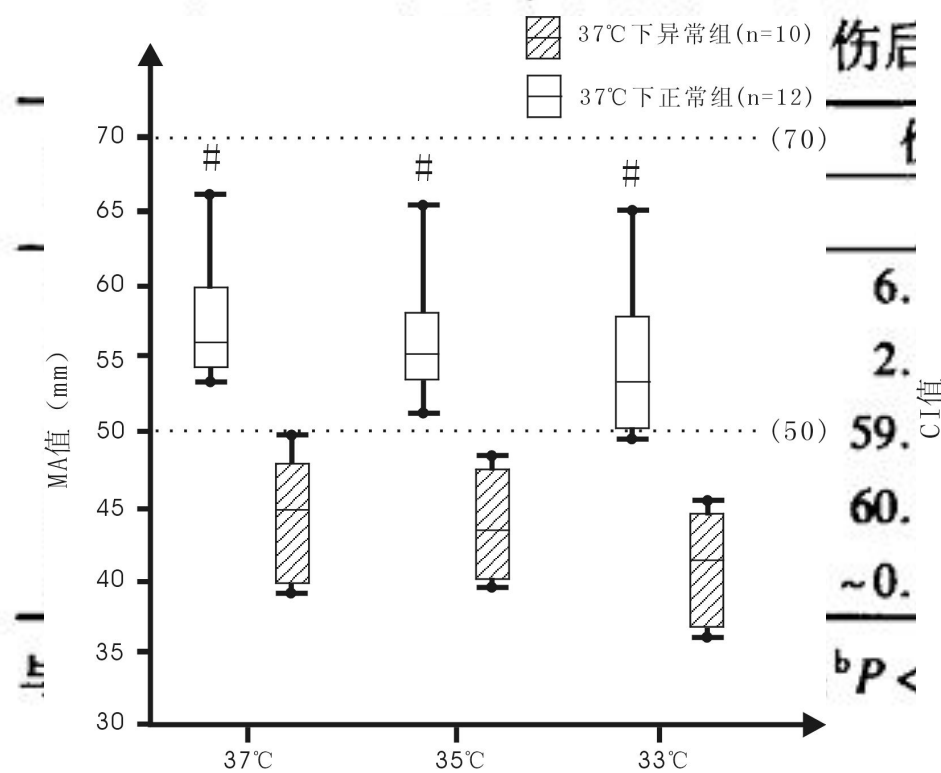
- **R12.1:** 推荐常规评估创伤后的凝血病，包括早期、重复、和联合检测凝血酶原时间（**PT**）、部分凝血活酶时间（**APTT**）、纤维蛋白原和血小板（**1C**）。
- **R12.2:** 推荐使用血栓弹力图帮助明确凝血病的特征和指导止血治疗（**1C**）。**2010版推荐为（2C）**





## 血栓弹力图在严重多发伤患者中的初步应用

蔡海英 叶立刚 徐善祥 张茂



中华创伤杂志, 2011, 27 (12): 1115-1117.

中华创伤杂志, 2013, 29 (1): 10-14.



## 四、重视组织氧合、输液和低体温



- **R13.1:** 对于没有脑损伤的患者，在严重出血控制之前  
应将收缩压维持在80-90mmHg (1C)

## Secondary Abdominal Compartment Syndrome After Severe Extremity Injury: Are Early, Aggressive Fluid Resuscitation Strategies to Blame?

**Table 4** Resuscitation Crystalloid and Blood Product Administered During Stages of Care

	Secondary ACS (n = 48)	Control (n = 48)	p
Prehospital fluid, L $\pm$ SD	2.69 $\pm$ 1.9	1.29 $\pm$ 1.13	<0.0001
Prehospital blood, L $\pm$ SD	0.13 $\pm$ 0.25	0.013 $\pm$ 0.06	0.003
ED fluid, L $\pm$ SD	2.7 $\pm$ 3.67	1.09 $\pm$ 1.23	0.0002
ED blood, L $\pm$ SD	0.35 $\pm$ 0.62	0.05 $\pm$ 0.18	0.0008
Prehospital or ED placed femoral access, n (%)	32 (66.7)	2 (4.2)	<0.0001
Rapid infuser use in ED, n (%)	6 (12.5)	0 (0.0)	0.01

**Table 5** Multiple Logistic Regression Model Combining Demographic, Injury Score, and Resuscitation Data

	Odds Ratio	Standard Error	z	p > z	95% Confidence Interval
Age	1.03	0.02	1.33	0.18	0.99–1.07
Gender	0.94	0.70	–0.08	0.94	0.22–4.08
GCS	1.10	0.16	0.66	0.51	0.83–1.47
Weighted RTS	0.52	0.25	–1.35	0.18	0.20–1.34
ISS	0.98	0.04	–0.60	0.55	0.90–1.06
Prehospital fluid*	1.99	0.64	2.16	0.03	1.07–3.73
ED fluid*	1.85	0.50	2.25	0.02	1.08–3.15

\* Significant predictors of developing secondary ACS.





- **R13.2: 对于合并严重颅脑损伤（GCS≤8）的失血性休克患者，应该维持平均动脉压≥80mmHg（1C）**

### Redefining hypotension in traumatic brain injury

Cherisse Berry, Eric J. Ley, Marko Bukur, Darren Malinoski, Daniel R. Margulies, James Mirocha, Ali Salim\*

*Conclusions:* Patients with isolated moderate to severe TBI should be considered hypotensive for SBP < 110 mm Hg. Further research should confirm this new definition of hypotension by correlation with indices of perfusion.

*Injury, Int. J. Care Injured 43 (2012) 1833–1837*

### The acute cardiopulmonary management of patients with cervical spinal cord injuries.

- Maintenance of mean arterial blood pressure between 85 and 90 mm Hg for the first 7 days following an acute spinal cord injury is recommended.

*Neurosurgery. 2013 Mar;72 Suppl 2:84-92*





## 关于输液的选择

- **R14.1:** 对于低血压的创伤出血患者应该进行液体治疗 (1A)
- **R14.2:** 首先选择使用晶体液 (1B)
- **R14.3:** 对于合并严重颅脑损伤的患者，应避免使用低渗溶液如乳酸格林氏液 (1C)
- **R14.4:** 如果选用胶体液，应该在相应制剂规定的剂量范围之内 (1B)
- **R14.5:** 对于钝性伤和颅脑损伤的患者，建议在早期可以使用高渗溶液，但与晶体液和胶体液相比并无明显优势 (2B)
- **R14.6:** 对于血流动力学不稳定的躯干穿透伤患者，推荐使用高渗液体 (2C)



- **R14.2: 首先选择使用晶体液（1B）**
- **R14.3: 对于合并严重颅脑损伤的患者，应避免使用低渗溶液如乳酸格林氏液（1C）**

## **Colloids versus crystalloids for fluid resuscitation in critically ill patients**

### **Authors' conclusions**

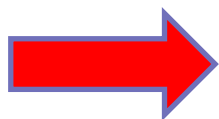
There is no evidence from randomised controlled trials that resuscitation with colloids reduces the risk of death, compared to resuscitation with crystalloids, in patients with trauma, burns or following surgery. Furthermore, the use of hydroxyethyl starch might increase mortality. As colloids are not associated with an improvement in survival and are considerably more expensive than crystalloids, it is hard to see how their continued use in clinical practice can be justified.

- **R14.4: 如果选用胶体液，应该在相应制剂规定的剂量范围之内（1B）**

## Update on the comparative safety of colloids: a systematic review of clinical studies.

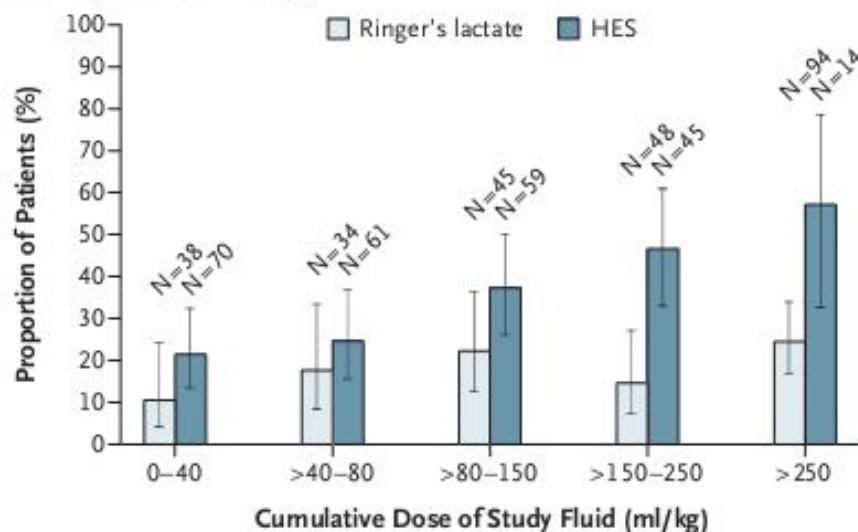
Groeneveld AB, Navickis RJ, Wilkes MM.

Department of Intensive Care, Vrije Universiteit Medical Center, Amsterdam, The Netherlands.

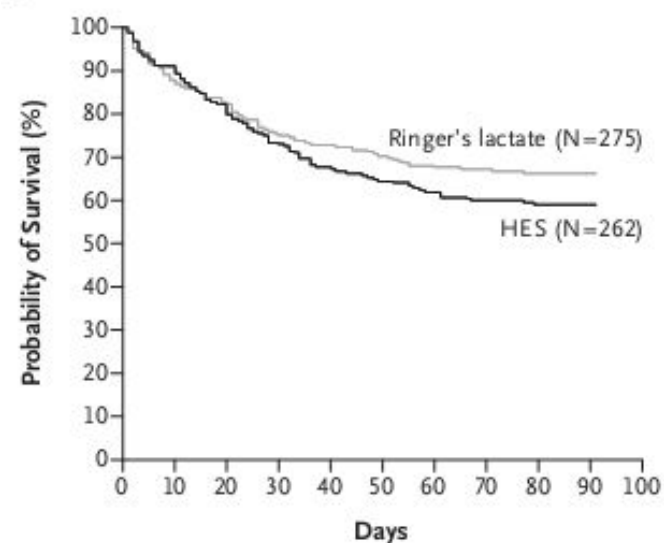


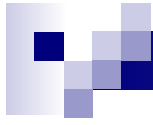
急性肾损伤、破坏凝血功能是不同的HES液的不良反应。

**A Renal-Replacement Therapy**



**B**





## 羟乙基淀粉被FDA黑框警告：成人重症患者不应使用HES溶液

- ◆ 对危重成人患者包括脓毒症及ICU监护患者，不应使用HES溶液。
- ◆ 对肾功能障碍患者禁止使用HES溶液。
- ◆ 一旦出现肾损伤征候立即中止使用HES。
- ◆ 有病例报告指出使用HES之后90天，仍需肾脏替代疗法，因此应当对所有患者进行至少90天的肾功能监测。
- ◆ 禁止已建立体外循环的开胸手术患者使用HES，以避免大出血。
- ◆ 一旦出现凝血紊乱立即中止使用HES。



- **R14.5:** 对于钝性伤和颅脑损伤的患者，建议在早期可以使用高渗溶液， 但与晶体液和胶体液相比并无明显优势（**2B**）

#### Comparison 2. colloid and hypertonic crystalloid versus isotonic crystalloid

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1 deaths	9		Risk Ratio (M-H, Fixed, 95% CI)	Subtotals only
1.1 albumin or PPF	1	14	Risk Ratio (M-H, Fixed, 95% CI)	0.5 [0.06, 4.33]
1.2 hydroxyethyl starch	0	0	Risk Ratio (M-H, Fixed, 95% CI)	Not estimable
1.3 modified gelatin	0	0	Risk Ratio (M-H, Fixed, 95% CI)	Not estimable
1.4 dextran	8	1283	Risk Ratio (M-H, Fixed, 95% CI)	0.88 [0.74, 1.05]



- **R14.6:** 对于血流动力学不稳定的躯干穿透伤患者，  
推荐使用高渗液体（2C）

## **Efficacy of Hypertonic Saline Dextran Fluid Resuscitation for Patients with Hypotension from Penetrating Trauma**

*Charles E. Wade, PhD, J. J. Grady, DrPH, and George C. Kramer, PhD*

### **Conclusion:**

**For patients with penetrating injuries to the torso that result in hypotension, initial fluid resuscitation with HSD is beneficial in improving survival, especially if surgery is subsequently required.**





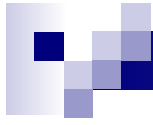
- **R15.1:** 对液体复苏无效的患者，推荐使用缩血管药物来维持目标的动脉血压（**2C**）
- **R15.2:** 对于心功能不全的患者，推荐使用正性肌力药物（**2C**）



- **R16.1:** 推荐早期采取措施减少热量丢失，对低体温的患者进行复温，以达到并维持正常的体温（1C)
- **R16.2:** 对于合并颅脑损伤的患者，一旦其它部位的出血得到控制，建议使用**33—35**的低温治疗并维持 $\geq 48\text{h}$ （2C)
  - ◆ 最易收益人群为GCS 4-7的患者
  - ◆ 应在伤后3h内启动
  - ◆ 通过头颅和颈部的降温达到选择性的降低颅脑温度
  - ◆ 低温治疗应持续48h以上
  - ◆ 复温应持续24h以上
  - ◆ 脑灌注压应维持在50mmHg以上

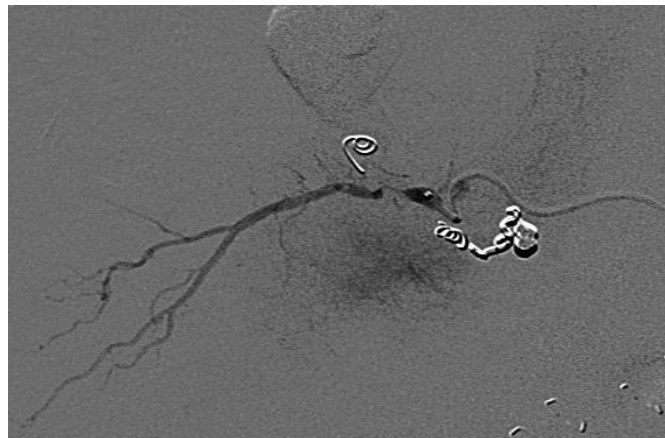
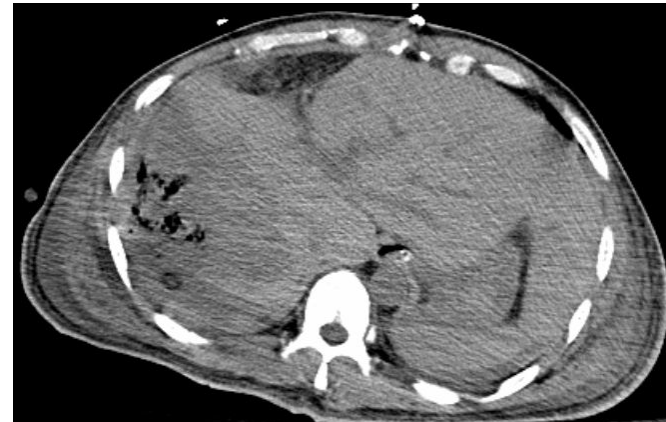
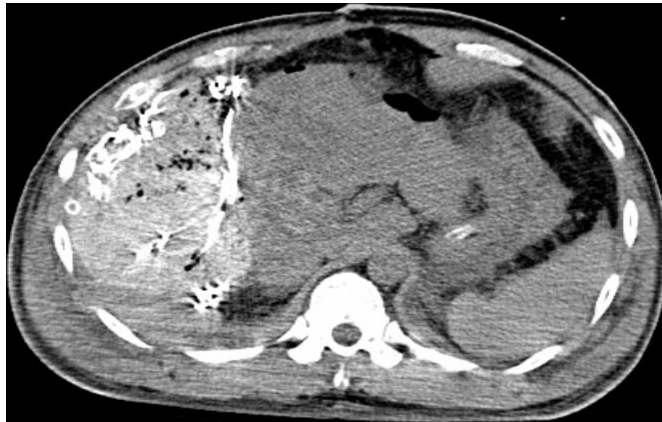


- **R17:** 推荐将血红蛋白值维持到7—9g/dl (1C)



## 五、迅速控制出血

- **R18:** 推荐使用填塞、直接外科手术止血以及局部止血措施达到早期控制腹腔出血。对于严重大出血濒临衰竭状态的患者，主动脉钳夹可作为辅助的措施（1C）



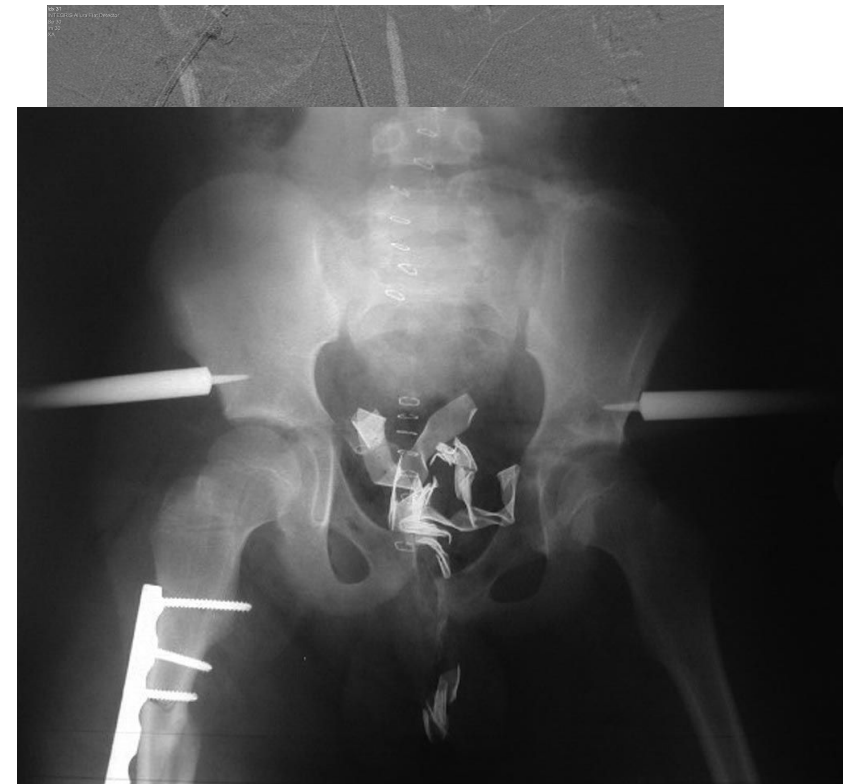
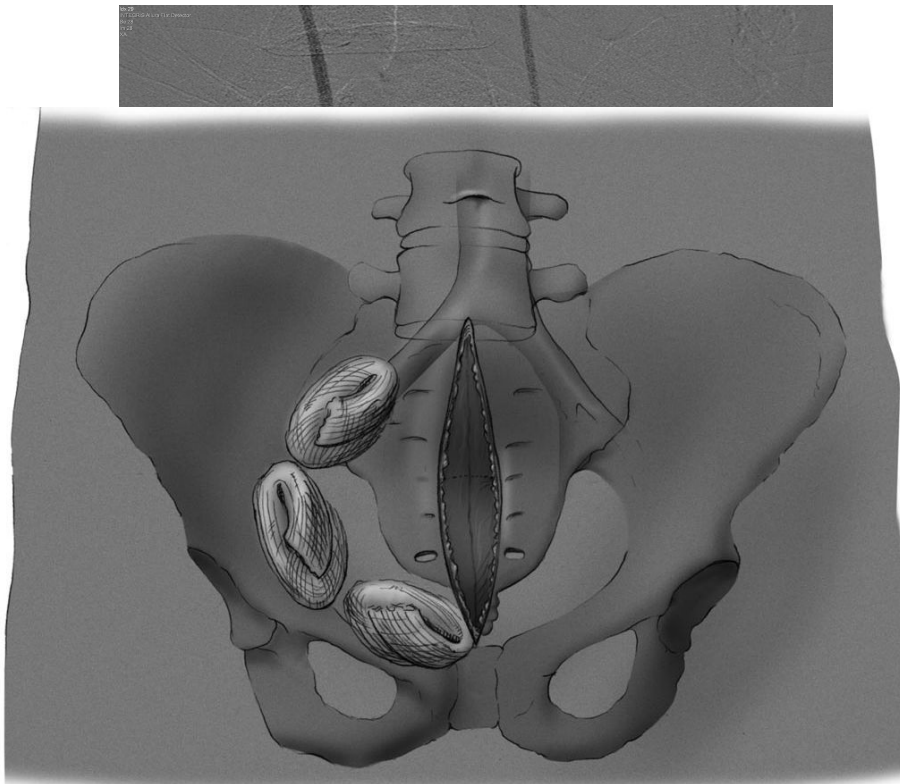


- **R19:**对于有失血性休克的骨盆环破裂的患者，推荐立即采用骨盆环关闭和稳定的措施（**1B**）



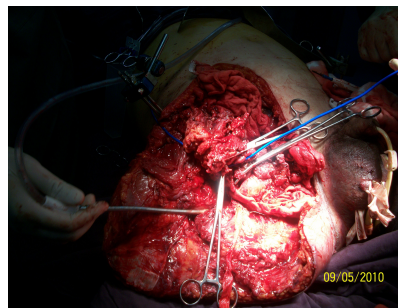
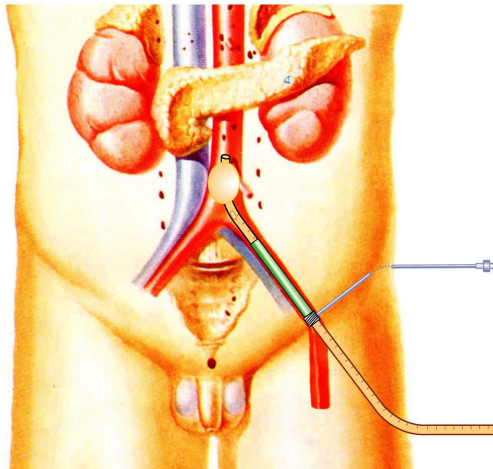


- **R20:** 对于骨盆环稳定后持续血流动力学不稳定的患者，推荐早期实施腹膜外填塞、动脉造影栓塞或外科手术控制出血（1B）





## 主动脉内球囊堵塞技术——临时止血





- **R21.1:** 对于合并重度失血性休克、有持续出血和凝血病征象的严重创伤患者，推荐实施损伤控制外科（1B）
- **R21.2:** 其它需要实施损伤控制外科的情况包括严重凝血病、低体温、酸中毒、难以处理的解剖损伤、耗时的操作、同时合并腹部以外的严重创伤（1C）
- **R21.3:** 对于血流动力学稳定且不存在上述情况的患者，推荐实施确定性外科手术（1C）



### Top 10 Greatest Army Inventions of 2007

Jacqueline M. Hames

Mouseover image to magnify



The Army's Top 10 Greatest Inventions of 2007 were recognized at a luncheon ceremony June 12, 2008, in Arlington, VA. GEN Benjamin S. Griffin, U.S. Army Materiel Command (AMC) Commanding General (CG), praised various research institutions for their inventions and outstanding achievements in providing the best technological solutions for Soldiers. "It's a tremendous accomplishment," Griffin said. "I'm very proud to be a part of this. I want to congratulate you all."

### Damage Control Resuscitation of Severely Injured Soldiers

U.S. Army Institute of Surgical Research

Fielded in January 2007, Damage Control Resuscitation limits fluid resuscitation by stabilizing the patient's blood pressure to minimize renewed bleeding from recently formed blood clots. Blood volume is restored using plasma as the primary resuscitation fluid along with packed red blood cells.





- **R22:** 对于实质脏器损伤伴有静脉出血或中等程度的动脉出血，推荐联合使用局部止血药物、其它外科方法或填塞止血（**1B**）

➤ 局部止血药的种类：

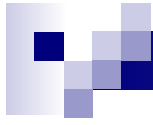
- a. 胶原类
- b. 明胶类
- c. 纤维类
- d. 纤维蛋白、粘合剂
- e. 多糖类
- f. 无机类（蒙脱石）

➤ 使用局部止血药物时应注意：

- a. 手术的类型
- b. 费用
- c. 凝血功能
- d. 出血程度
- e. 不同局部止血药的不同特性



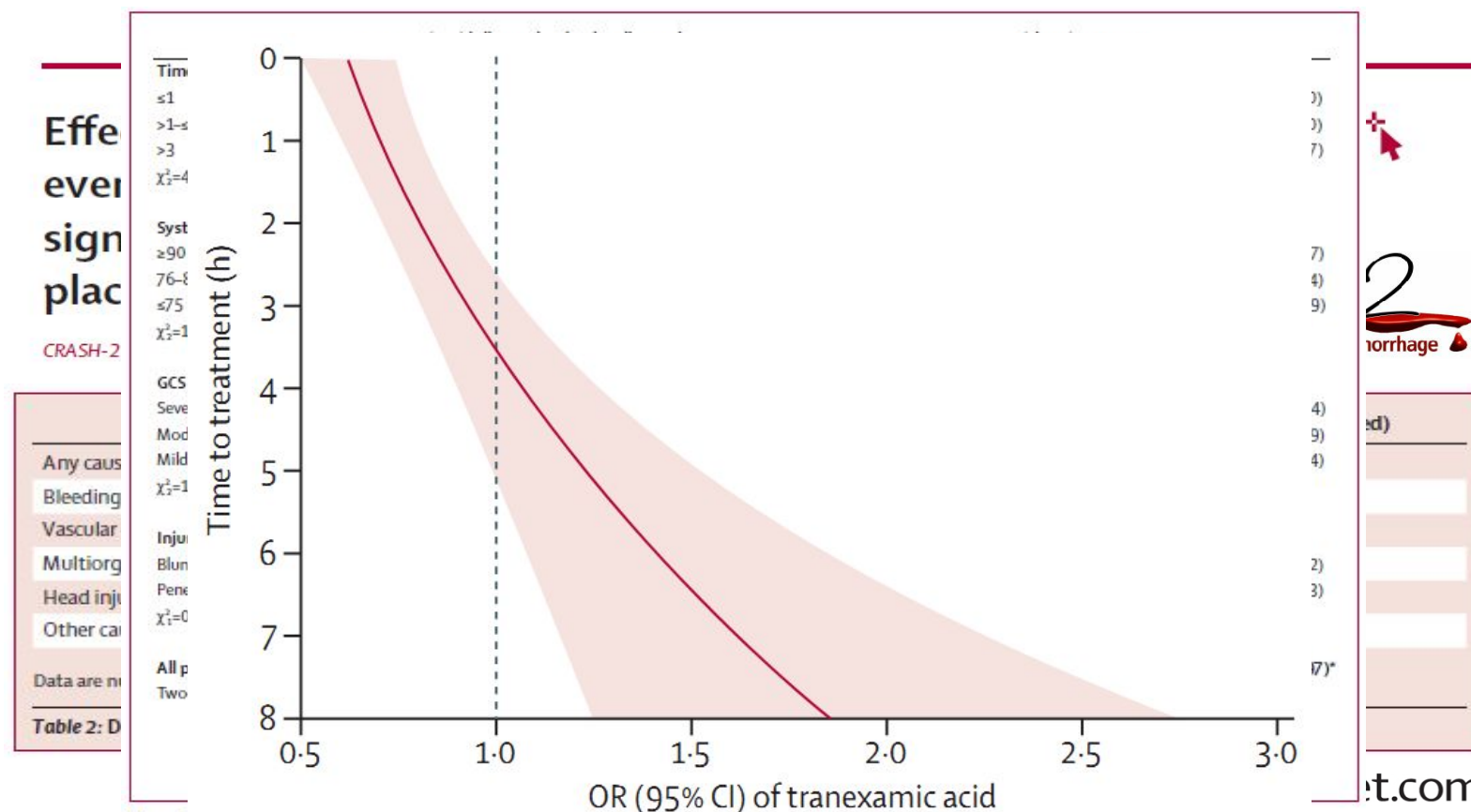
## 六、出血和凝血功能障碍的处理



- **R23: 推荐尽早检测并采取措施维持凝血功能（1C）**
  - 通常要送到中心实验室检测，耗时长（20~60 min）
  - 常规指标只反映凝血初始阶段的功能
  - 体外检测不能真实反映体内的凝血功能
  - 血小板计数和纤维蛋白原只提供数值，不能反映功能
  - 床旁快速检测技术（**point-of-care test**）
  - 血小板功能检测
  - 血栓弹力图（**TEG**）



- **R24.1:** 对于出血或存在大出血风险的患者，推荐尽早使用氨甲环酸，首剂1g（给药时间大于10min），后续1g输注持续8h（1A）
- **R24.2:** 创伤出血患者应该在伤后3h内使用氨甲环酸（1B）
- **R24.3:** 建议制定创伤出血处理流程，考虑在患者转送医院的途中应用首剂的氨甲环酸（2C）



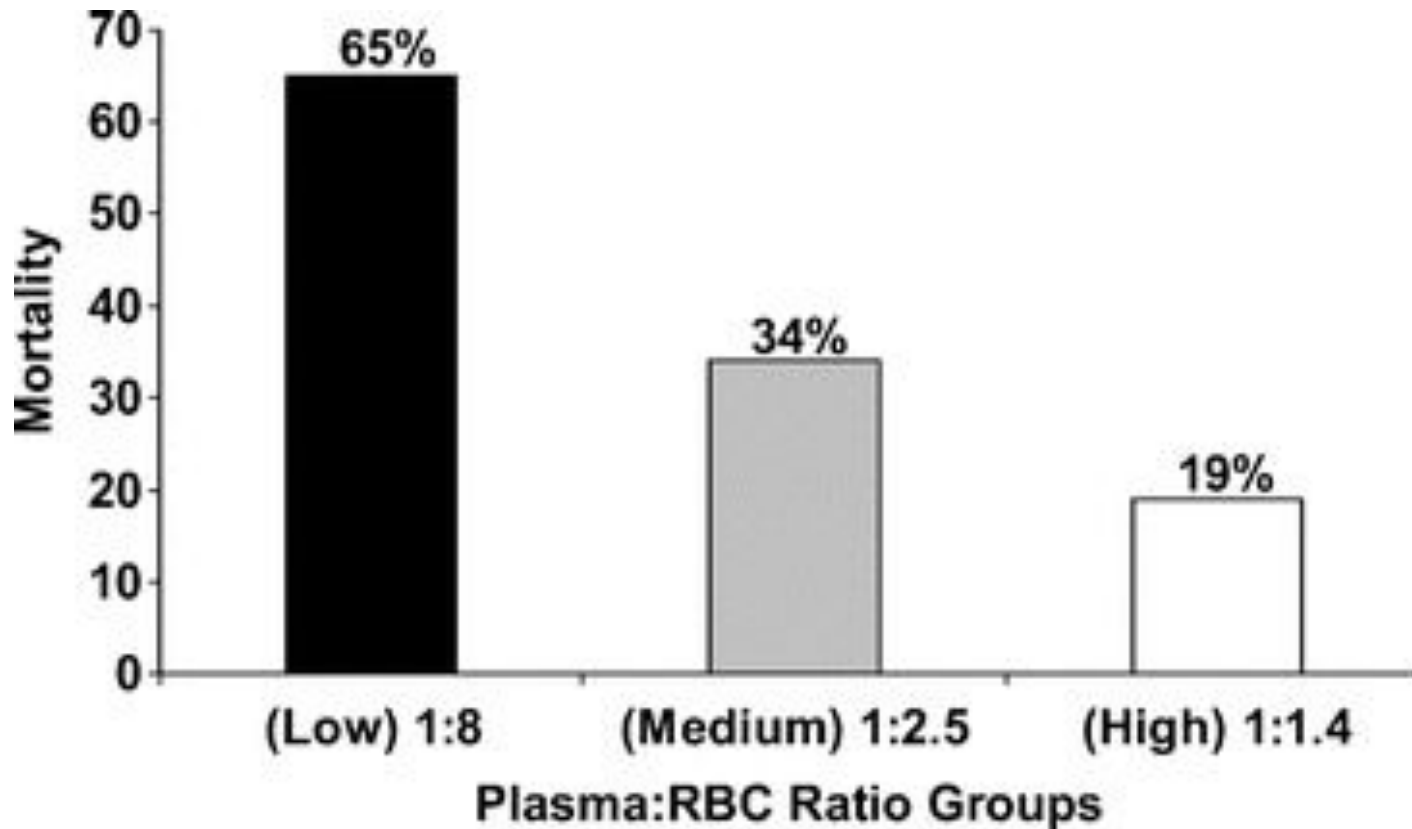


- **R25.** 对于大量输血的患者，推荐监测血浆离子钙水平并维持在正常范围。（1C）

## Concentration-dependent effect of hypocalcaemia on mortality of patients with critical bleeding requiring massive transfusion: a cohort study

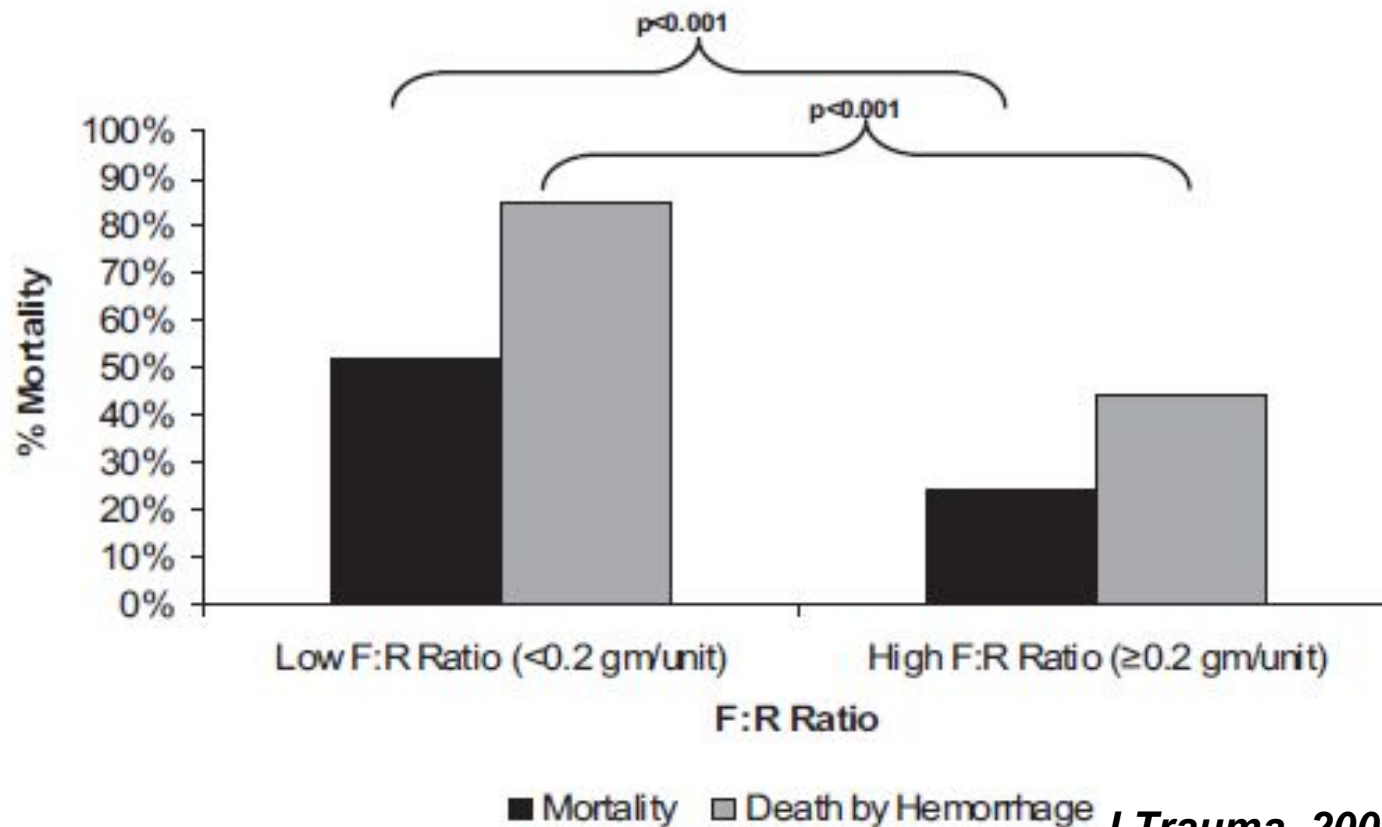
*Hypocalcaemia was common (mean concentrations 0.77 mmol/l, SD 0.19) and had a linear, concentration-dependent relationship with mortality (odds ratio [OR] 1.25 per 0.1 mmol/l decrement, 95% confidence interval [CI]: 1.04 to 1.52; P=0.02). Hypocalcaemia accounted for 12.5% of the variability and was more important than the lowest fibrinogen concentrations (10.8%), acidosis (7.9%) and lowest platelet counts (7.7%) in predicting hospital mortality. The amount of fresh frozen plasma transfused (OR 1.09 per unit, 95% CI: 1.02 to 1.17; P=0.02) and acidosis (OR 1.45 per 0.1 decrement, 95% CI: 1.19 to 1.72; P=0.01) were associated with the occurrence of severe hypocalcaemia (<0.8 mmol/l). In conclusion, ionised calcium concentrations had an*

- **R26.1:** 对于大出血的患者，推荐早期应用血浆（新鲜冰冻血浆或病原体灭活的血浆）(1B)或纤维蛋白原（1C）
- **R26.2:** 如果需要继续使用血浆，建议血浆:红细胞的输注比例至少达到1:2（2C）
- **R26.3:** 对于没有大量出血的患者不推荐使用血浆（1B）



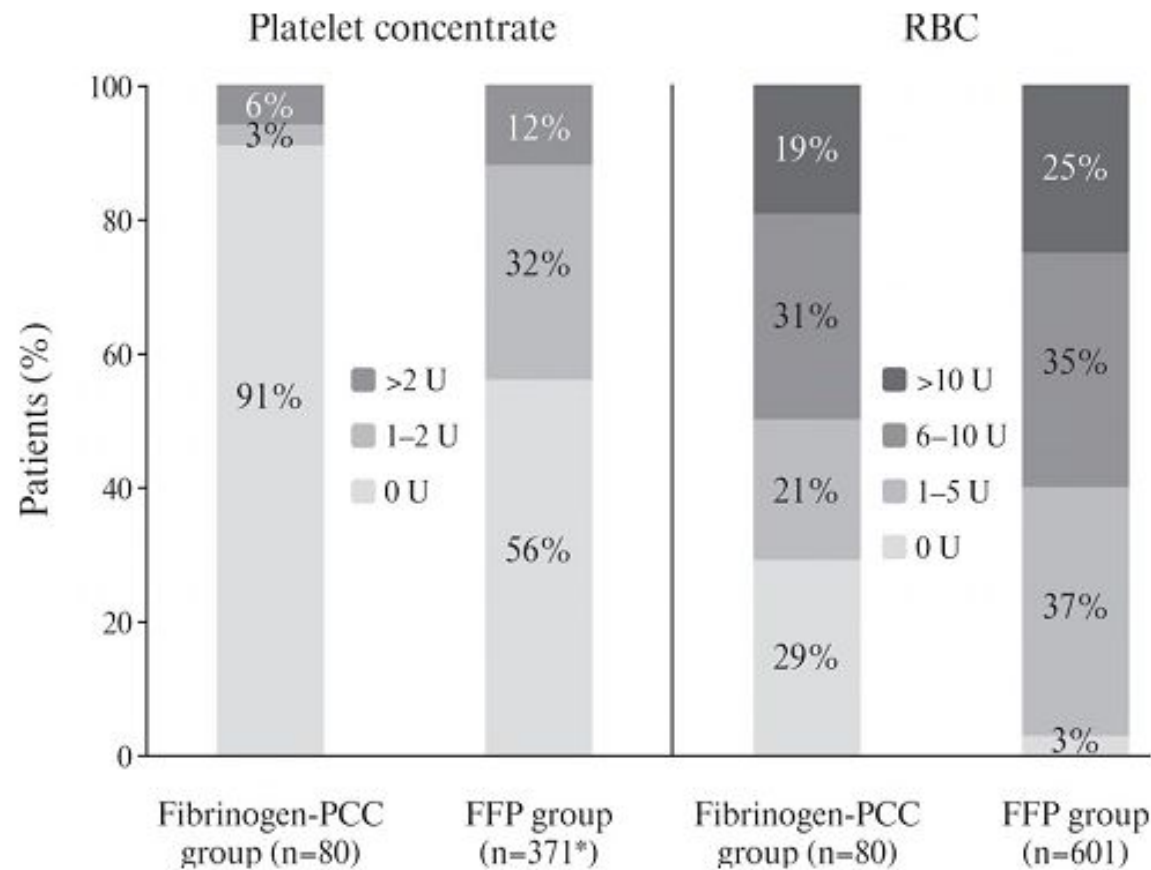
*J Trauma, 2007, 63(4): 805-813.*

- **R27.1:** 如果患者有大出血，血栓弹力图提示功能性纤维蛋白原缺乏或血浆纤维蛋白原水平 $\leq 1.5$ — $2.0\text{g/l}$ ，推荐输注纤维蛋白原或冷沉淀（1C）
- **R27.2:** 推荐的起始剂量纤维蛋白原为3—4g，冷沉淀为 $50\text{mg/Kg}$ 。对于70Kg的成人，大约相当于15—20单位。然后根据血栓弹力图和纤维蛋白原的检测水平指导是否继续输注（2C）

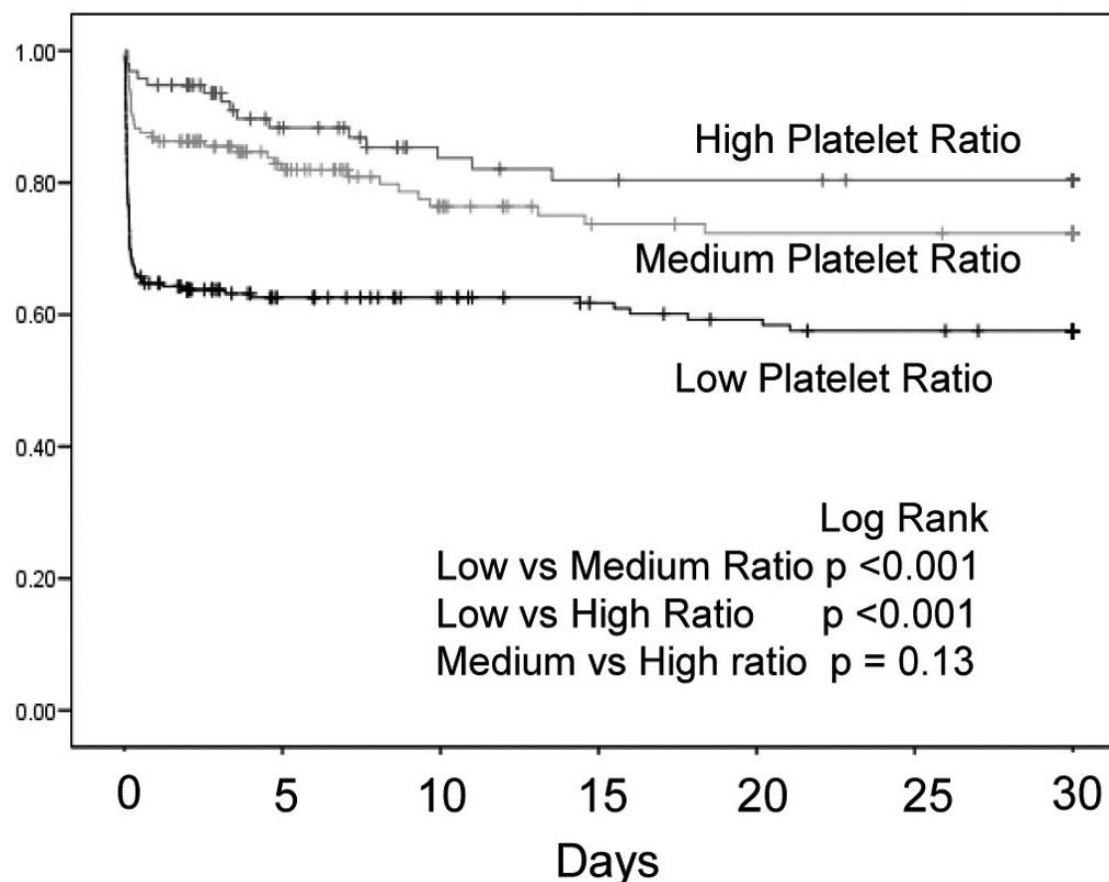




## ***Transfusion in trauma: thromboelastometry-guided coagulation factor concentrate-based therapy versus standard fresh frozen plasma-based therapy***



- **R28.1:** 推荐输注血小板以维持血小板计数大于 $50 \times 10^9 /L$  (1C)
- **R28.2:** 对于持续出血和或创伤性脑损伤的患者, 建议将血小板计数维持在 $100 \times 10^9/L$ 以上 (2C)
- **R28.3:** 建议输注的起始剂量为4—8单位血小板, 或者1个全血单位血小板 (2C)







- **R29.1:** 建议对接受抗血小板治疗的大出血或者颅内出血的患者输注血小板 (2C)
- **R29.2:** 如果患者单独使用阿司匹林, 建议使用去氨加压素 (0.3ug/Kg) (2C)
- **R29.3:** 对于接受或怀疑接受抗血小板治疗的患者, 建议检测血小板功能 (2C)
- **R29.4:** 如果明确血小板功能不良且患者存在持续的微血管性出血, 建议使用浓缩血小板治疗 (2C)

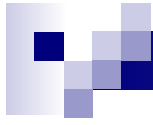


## 常规检测血小板功能，识别隐匿的血小板功能抑制以及减少不必要的血小板输注

1. 部分未使用抗血小板药物的患者，呈现血小板功能抑制
2. 20%-30%的患者对阿司匹林或氯吡格雷没有反应
3. 联合使用抗血小板药物对血小板的抑制作用更强



- **R30.1:** 对于使用抑制血小板药物和血管性血友病的患者，建议使用去氨加压素（0.3ug/Kg）（2C）
- **R30.2:** 不建议在创伤出血患者中常规使用去氨加压素（2C）

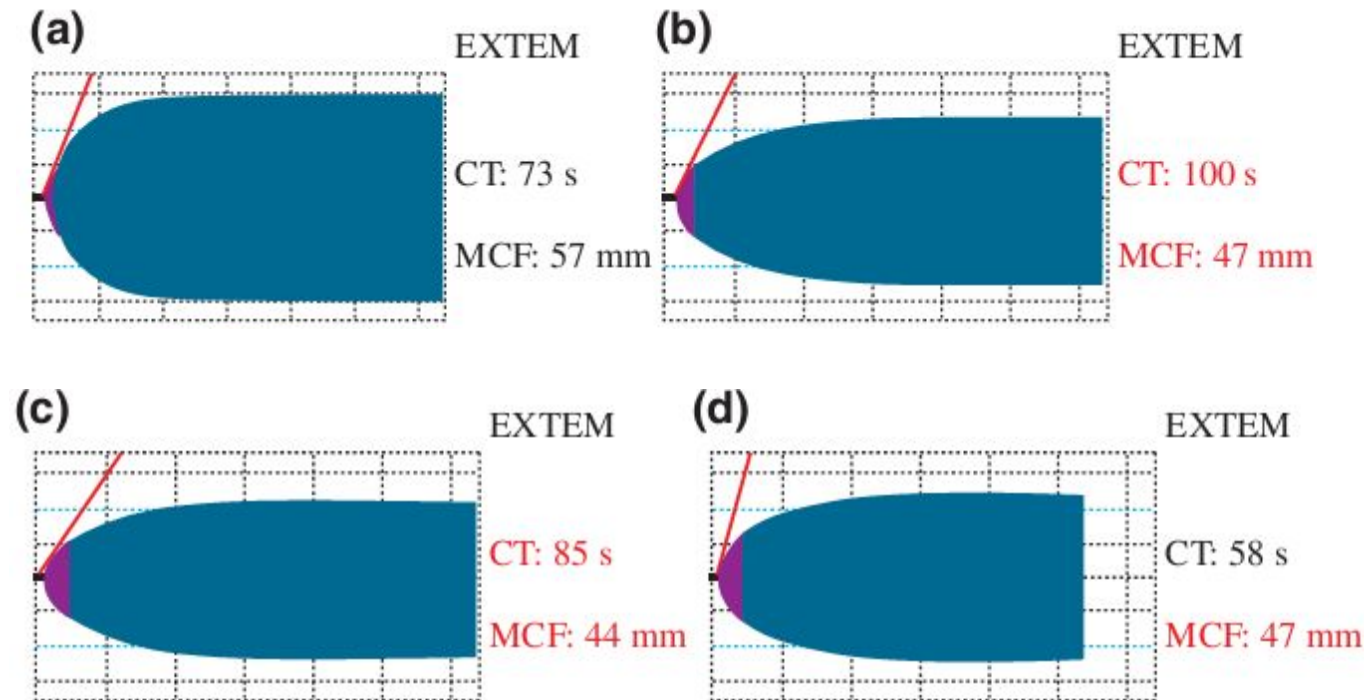


- **R31.1:** 对于口服维生素k依赖抗凝药的患者，推荐早期使用浓缩的凝血酶原复合物进行紧急拮抗（**1B**）
- **R31.2:** 如果实施基于浓缩凝血酶原复合物的目标导向治疗策略，对于血栓弹力图提示有凝血启动延迟的出血患者，建议使用凝血酶原复合物（**2C**）



## CASE REPORT

### *Use of rotation thromboelastometry (ROTEM) to achieve successful treatment of polytrauma with fibrinogen concentrate and prothrombin complex concentrate*



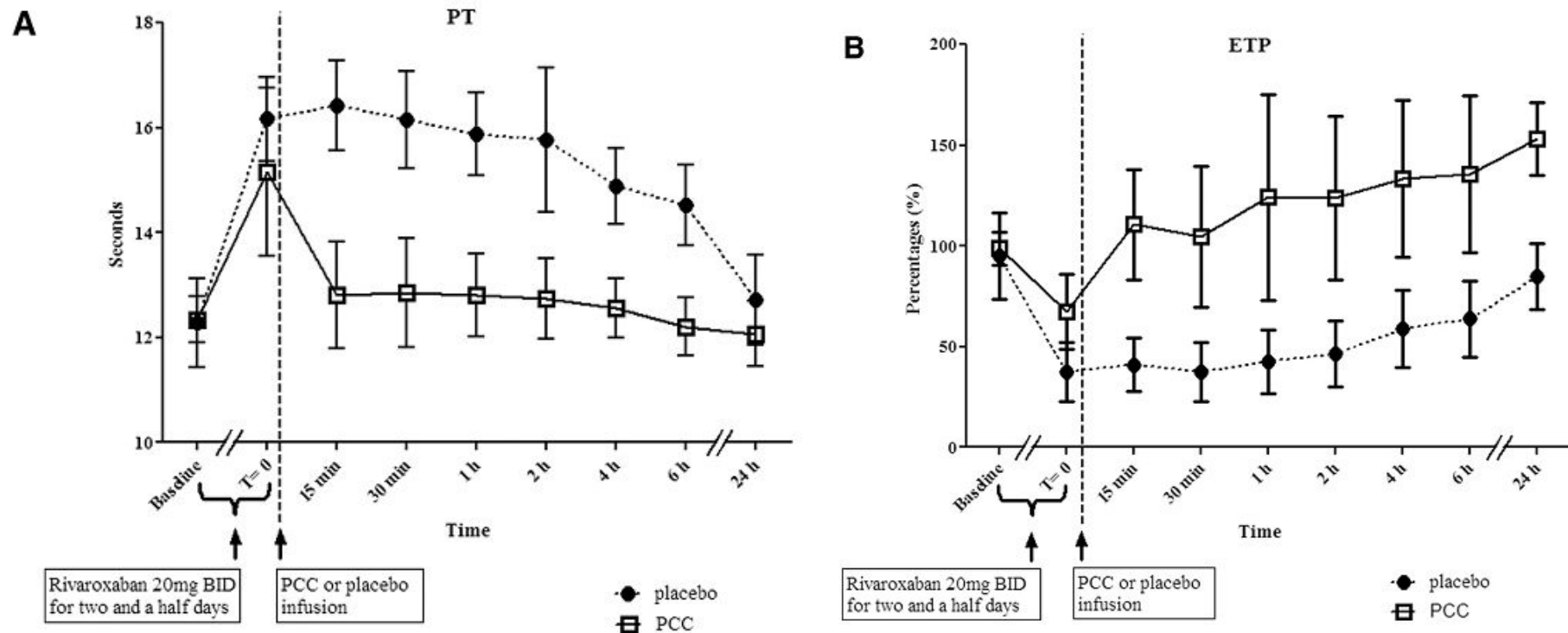


- **R32.1:** 对于使用或怀疑使用抗 X a 因子药物如利伐沙班、阿哌沙班、依度沙班的患者，建议检测底物特异性的抗 X a 因子活性（2C）
- **R32.2:** 如果存在致命性出血，建议使用大剂量的凝血酶原复合物（25-50U/Kg）以逆转利伐沙班、阿哌沙班、依度沙班的效应（2C）
- **R32.3:** 对于口服或怀疑口服凝血酶抑制剂（达比加群）的患者，不建议使用凝血酶原复合物（2B）





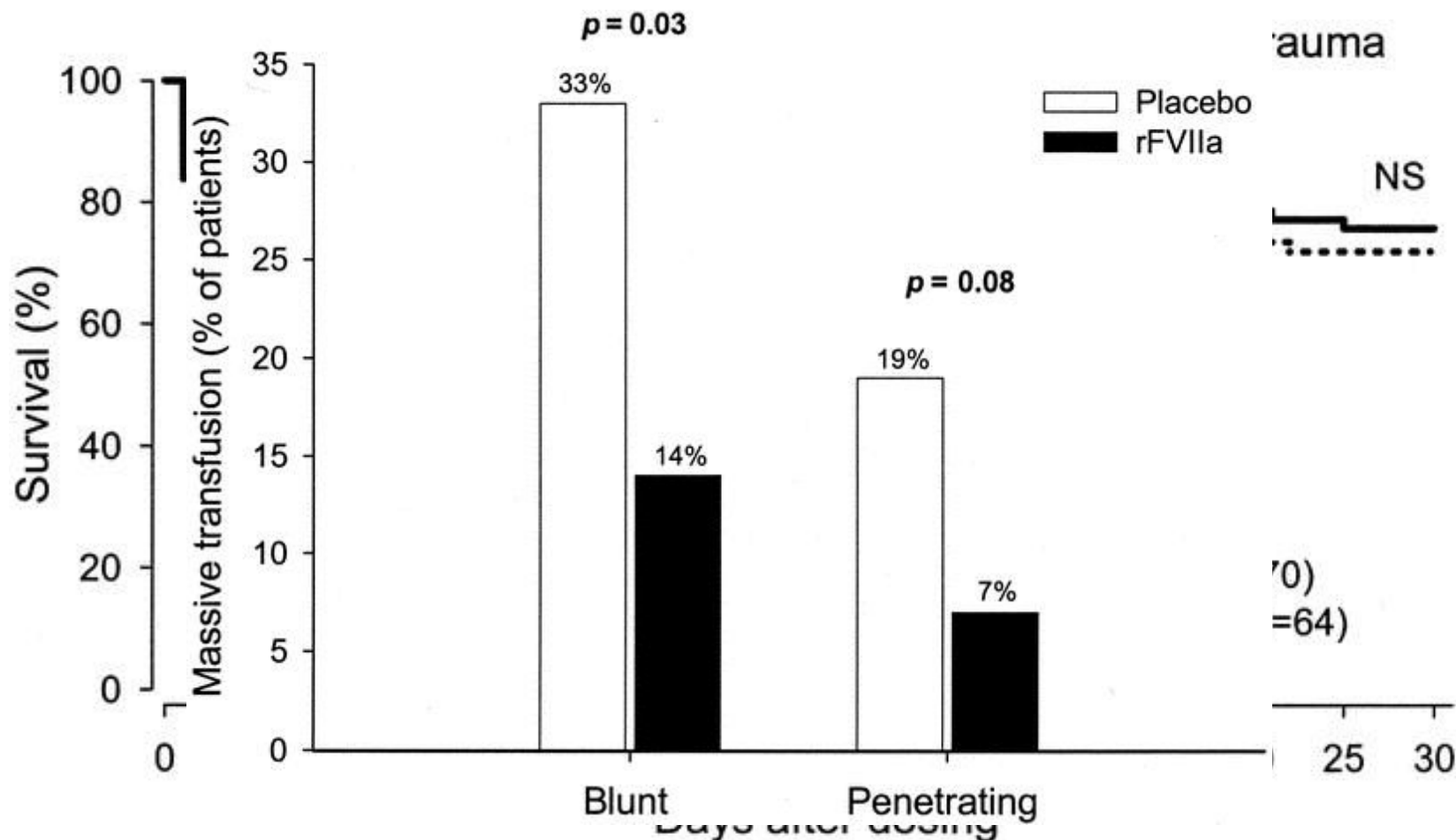
## ***Randomized, Placebo-Controlled, Crossover Study in Healthy Subjects Reversal of Rivaroxaban and Dabigatran by Prothrombin Complex Concentr***





- **R33.1:** 对于已经采取标准的控制出血的努力和最佳的传统止血措施的患者，如果持续存在大出血和创伤性凝血病，建议使用基因重组的活化VII因子（**RfVIIa**）（**2C**）
- **R33.2:** 对于单独颅脑损伤引起的颅内出血，不建议使用**RfVIIa**（**2C**）

# *rFVIIa*减少钝性伤员红细胞输注量，对穿透伤患者及总体死亡率没有影响



Boffard KD, et al. *J Trauma*, 2005, 59(1): 8-15.



## A retrospective case control study of recombinant factor VIIa in patients with intracranial haemorrhage caused by trauma

Table II. Comparison with other studies.

	rFVIIa patients, n	Control patients, n	% of rFVIIa patients dead	% of control patients dead
Present study	35 (0 on warfarin)	35 (0 on warfarin)	45.7%	14.3%
Stein <i>et al</i> (2009)	68 (66% on warfarin)	111 (48.6% on warfarin)	26.5%	18.9%
Stein <i>et al</i> (2008)	29 (24% on warfarin)	34 (12% on warfarin)	34.5%	32.4%
McQuay <i>et al</i> (2009)	18 (38.8% on warfarin)	None	55.6%	n/a
Kluger <i>et al</i> (2007)	17 (? on warfarin)	13 (? on warfarin)	29.4%	24.2%
Nishijima <i>et al</i> (2010)	20 (All on warfarin)	20 (All on warfarin)	35%	35%
Zaaroor <i>et al</i> (2008)	12 (0% on warfarin)	None	16.7%	n/a
Sutherland <i>et al</i> (2008)	15 (27% on warfarin)	None	13.3%	n/a
Narayan <i>et al</i> (2008)	61 (Warfarin n/a)	36 (Warfarin n/a)	11%	11%
Bartal <i>et al</i> (2007)	15 (46% on warfarin)	None	0%	n/a
Brown <i>et al</i> (2010)	14 (57% on warfarin)	14 (14% on warfarin)	50%	29%



- **R34.1:** 建议尽早采用物理措施预防深静脉血栓，包括间歇性气囊加压装置（**IPC**）和/或抗血栓弹力袜（**2C**）
- **R34.2:** 推荐出血控制后**24h**内使用药物预防血栓（**1B**）
- **R34.3:** 不推荐常规使用下腔静脉滤器预防血栓（**1C**）



## 七、救治流程





- **R35.** 推荐每家医疗机构对创伤出血患者实施具有循证医学依据的救治流程。 **(1C)**
- **R36.** 推荐使用救治核查表单以指导临床处理。 **(1B)**
- **R37.** 推荐每家医疗机构在日常质量管理中，应该包括对救治流程遵循情况的评估。 **(1C)**

# Deviations from evidence-based clinical management guidelines increase mortality in critically injured trauma patients\*

Todd W. Rice, MD, MSc, FCCP; Stephen Morris, PhD; Bartholomew J. Tortella, MD, MBA, FACS, FCCM; Arthur P. Wheeler, MD, FCCP; Michael C. Christensen, MSc, MPA, DrPH

Table 5. Effect of overall compliance with clinical management guidelines

Category <sup>a</sup>	Unadjusted (95% Confidence Interval)			Adjusted <sup>d</sup> (95% Confidence Interval)		
	Odds Ratio <sup>a</sup>	<i>p</i>		Odds Ratio <sup>a</sup>	<i>p</i>	
30-day mortality	1.10 (0.60, 1.60)	.000		1.00 (0.60, 0.60)	.744	
90-day mortality	1.10 (0.60, 1.60)	.000		1.00 (0.60, 0.60)	.002	

**遵循指南能够改善严重创伤的救治效果！**

## Guideline compliance in trauma: Evidence-based protocols to improve trauma outcomes?\*

Ventilation-free days (number) <sup>c</sup>								
Moderate deviation	-3.82	(0.85)	[-4.51]	<.001	-3.03	(0.79)	[-3.83]	<.001
Major deviation	-5.05	(1.92)	[-2.64]	.010	-1.80	(1.88)	[-0.95]	.342
Renal failure-free days, Sequential Organ Failure Assessment score 3+ (n) <sup>c</sup>								
Moderate deviation	-0.21	(0.73)	[-0.28]	.776	-0.82	(0.62)	[-1.33]	.188
Major deviation	-5.87	(1.89)	[-3.11]	.002	-4.63	(1.51)	[-3.07]	.003
Renal failure-free days, renal replacement therapy (n) <sup>c</sup>								
Moderate deviation	0.21	(0.67)	[0.31]	.760	-0.05	(0.64)	[-0.08]	.934
Major deviation	-5.43	(1.86)	[-2.92]	.004	-4.07	(1.46)	[-2.79]	.006



1. 成人ICU内新出现发热的处理指南（2008版）. 中华急诊医学杂志, 2009, 18(4): 352-354.
2. 成年危重患者营养评估与支持治疗指南. 中华急诊医学杂志, 2009, 18(8): 802-803.
3. 美国西部创伤学会关于血流动力学不稳定骨盆骨折的处理指南. 中华急诊医学杂志, 2009, 18(8): 801-802.
4. 成人创伤与危重患者红细胞输注指南. 中华急诊医学杂志, 2010, 19(6): 580-581.
5. 钝性脑血管损伤临床处理指南. 中华急诊医学杂志, 2010, 19(6): 582.
6. 严重创伤出血处理的欧洲指南（2010年版）. 中华急诊医学杂志, 2010, 19(8): 795-796.
7. 腹部穿透伤选择性非手术治疗的实践指南. 中华急诊医学杂志, 2010, 19(8): 796.
8. 孕妇创伤的诊断和处理指南. 中华急诊医学杂志, 2010, 19(10): 1013.
9. 成人非糖尿病危重患者血糖控制国际指南. 中华急诊医学杂志, 2010, 19(12): 1244.
10. 欧洲危重病医学会关于急性胃肠损伤的定义和处理指南. 中华急诊医学杂志, 2012, 21(8): 812-814.
11. 美国西部创伤学会关于肢体毁损伤处理的指南. 中华急诊医学杂志, 2012, 21(9): 957-960.
12. 美国东部创伤外科学会关于骨盆骨折出血处理的指南. 中华急诊医学杂志, 2012, 21(9): 960-961.



· 专家论坛 ·

## 关注严重创伤救治中的 几个重要问题

中华急诊医学杂志 2008 年 9 月第 17 卷第 9 期 Chin J Emerg Med, September 2008, Vol. 17, No. 9

· 901 ·

徐少文 张茂 干建新

· 述评 ·

## 提高对挤压综合征的认识和救治水平

中华急诊医学杂志 2010 年 5 月第 19 卷第 5 期 徐少文 张茂

· 述评 ·

## 重视超声在严重创伤救治中的应用

徐少文 张茂 干建新

· 344 ·

中华急诊医学杂志 2009 年 4 月第 18 卷第 4 期 Chin J Emerg Med, April 2009, Vol. 18, No. 4

· 专家论坛 ·

## 重视创伤救治中的辐射损伤 重视对创伤性凝血病的认识与防治

徐少文 张茂

徐少文 张茂 干建新



## Checklist具有很高的实用价值

Table 4. Treatment pathway checklist.

<u>Treatment phase</u>	Yes	No	N/A	Reason for variance
<b>Initial assessment &amp; management</b>				
Extent of traumatic haemorrhage assessed	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Patient in shock with identified source of bleeding treated immediately	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Patient in shock with unidentified source of bleeding sent for further investigation	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Coagulation, haematocrit, serum lactate, base deficit assessed	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Antifibrinolytic therapy initiated	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Patient history of anticoagulant therapy assessed (vitamin K antagonists, antiplatelet agents, oral anticoagulants)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
<b>Resuscitation</b>				
Systolic blood pressure of 80-100 mmHg achieved in absence of TBI	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Measures to achieve normothermia implemented	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Target Hb level 7-9 g/dL achieved	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	



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**Surgical intervention**

Abdominal bleeding control achieved	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Pelvic ring closed & stabilised	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Peritoneal packing, angiographic embolisation or surgical bleeding control completed in haemodynamically unstable patient	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Damage control surgery performed in haemodynamically unstable patient	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Local haemostatic measures applied	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Thromboprophylactic therapy recommended	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

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**Coagulation management**

Coagulation, haematocrit, serum lactate, base deficit, calcium reassessed	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Target fibrinogen level 1.5-2 g/L achieved	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Target platelet level achieved	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Prothrombin complex concentrate administered if indicated due to vitamin-K antagonist or viscoelastic monitoring	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>





## AAST 2010 PLENARY PAPER

# Moving from “optimal resources” to “optimal care” at trauma centers

## 严重创伤救治过程的质控是提高救治效果的重要保证！

- BACKGROUND:** The Trauma Quality Improvement Program has shown that risk-adjusted mortality rates at some centers are nearly 50% higher than at others. This “quality gap” may be due to different clinical practices or processes of care. We have previously shown that adoption of processes called core measures by the Joint Commission and Centers for Medicare and Medicaid Services does not improve outcomes of trauma patients. We hypothesized that improved compliance with trauma-specific clinical processes of care (POC) is associated with reduced in-hospital mortality.
- METHODS:** Records of a random sample of 1,000 patients admitted to a Level I trauma center who met Trauma Quality Improvement Program criteria (age  $\geq 16$  years and Abbreviated Injury Scale score  $\geq 3$ ) were retrospectively reviewed for compliance with 25 trauma-specific POC (T-POC) that were evidence-based or expert consensus panel recommendations. Multivariate regression was used to determine the relationship between T-POC compliance and in-hospital mortality, adjusted for age, gender, injury type, and severity.
- RESULTS:** Median age was 41 years, 65% were men, 88% sustained a blunt injury, and mortality was 12%. Of these, 77% were eligible for at least one T-POC and 58% were eligible for two or more. There was wide variation in T-POC compliance. Every 10% increase in compliance was associated with a 14% reduction in risk-adjusted in-hospital mortality.
- CONCLUSION:** Unlike adoption of core measures, compliance with T-POC is associated with reduced mortality in trauma patients. Trauma centers with excess in-hospital mortality may improve patient outcomes by consistently applying T-POC. These processes should be explored for potential use as Core Trauma Center Performance Measures. (*J Trauma*. 2012;72: 870–877. Copyright © 2012 by Lippincott Williams & Wilkins)



## 创伤大出血规范处理的质量监控指标

- ◆对早期复苏无效的低血压患者从受伤至启动止血措施的时间
- ◆从入院至得到全套血液检查结果的时间
- ◆离开急诊室前使用TXA的患者比例
- ◆不明确出血来源的出血患者从入院至CT检查的时间
- ◆损伤控制外科的执行情况
- ◆血栓预防的执行情况



## 规范与质量——提高严重创伤救治水平的保障



- SOP
- Checklist
- PDCA
- QCC
- .....



