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				Mutschler, 2013
Signs and Symptoms of Hemorrhage by Class				
PARAMETER	CLASS I	CLASS II	CLASS III	CLASS IV
Blood loss	< 15%	15-30%	31-40%	> 40%
HR	\leftrightarrow	$ \Longleftrightarrow $	1	
BP	\Leftrightarrow	$ \Longleftrightarrow $	Ļ	↓
PP	\leftrightarrow	Ļ	Ļ	Ļ
RR	\leftrightarrow	$ \Longleftrightarrow $	1	1
UO	\leftrightarrow	$ \Longleftrightarrow $	Ļ	11
GCS	\leftarrow	\leftarrow	Ļ	
Base Deficit	0 to -2	-2 to -6	-6 to -10	-10 or less
Need for blood?	Monitor	Possible	Yes	Massive Transfusion
Mortality: 7% 51%				→ 51%
Transfused Blood	: 1.5 units -			→ 20.3 units





























s a pa		dication	s for Thoracotomy
ng		(after	r chest tube in trauma)
	Adulta	Immediate output	> 1.5 L in first hour
Aduits	Adults	Ongoing Output	> 200 cc/hr over next 2-4 hours
	Children	Immediate output	> 20 mL/kg in first hour
		Ongoing Output	> 3 mL/kg/hr over next 2-4 hours









DIGITAL RECTAL EXAM FOR URETHRAL INJURY



Ball, 2009

- Retrospective review of 41 patients
- Blunt trauma specific

Results

- DRE: 2%
- Blood at the urethral meatus: 20%
- Hematuria prior to catheter insertion: 17%

"DRE remains clinically indicated in patients with penetrating trauma in the vicinity of the rectum, pelvic fractures, and spinal cord injuries..."



PREPERITONEAL PELVIC PACKING

Cothren, 2007

- 12 units (pre-PPP) vs 6 units (post-PPP)
- 75% reduction in need for angiography
- No deaths from blood loss
- Lower mortality

"PPP is a rapid method for controlling pelvic fracture-related hemorrhage that can supplant the need for emergent angiography."





	earch "QT interval" or 📃	and the second s
Glasgow Coma Coma severity based	Scale/Score (GCS) d on Eye (4), Verbal (5), and Motor	ALZ Z
When to Use 🗸	Pearls/Pitfalls V Why Use V	
Best eye response	Spontaneously (+4)	
	To verbal command (+3)	
	To pain (+2)	
	MARK BROCK ON THE REPORT	

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GOALS OF TREATMENT OF BRAIN INJURY

Clinical Parameters

- SBP <u>>100 mm Hg</u>
- Temperature 36-38 C

Monitoring Parameters

- CPP <u>> 60 mmHg</u>
- ICP 5-15 mmHg
- $PbtO_2 \ge 15 \text{ mmHg}$
- Pulse Oximetry ≥ 95%

Lab Values

- Glucose 80-180
- Hgb ≥ 7
- INR <u><</u> I.4
- Na 135-145
- PaO₂ ≥ 100 mmHg
- PaCO₂ 35-45 mmHg
- PH 7.35-7.45
- Platelets <u>></u> 75 x 10³/mm³



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HEAD INJURY ON ANTICOAGULATION

Admission for neurologic observation

- All supra-therapeutically anticoagulated patients
- CT abnormality

Anticoagulation Reversal

Consideration given to short term reversal of anticoagulation

Timing of repeat Head CT

- At at 12 to 18 hours
- or when even subtle signs of neurologic worsening occurs



Cohen, 2006











NEW MYOTOME DIAGRAM

Muscle Strength Grading		Myotomes		
Score	Result	C5	Elbow flexors (biceps)	
0	Total paralysis	C6	Wrist extensors	
I	Palpable or visible contraction	C7	Elbow extensors (triceps)	
2	Full range of motion with gravity eliminated	C8	Finger flexors	
3	Full range of motion against gravity	ТΙ	Finger abductors	
4	Full range of motion, but < normal strength	L2	Hip flexors	
5	Normal strength	L3	Knee extensors	
NT	Not testable	L4 /	Ankle dorsiflexion	
"Key myotomes are used to evaluate the		L5	Long toe extensors	
		SI	Ankle plantar flexors	
	level of motor function"			











IV Antibiotics (weight-based dosing guidelines)					
Open Fractures	I st Generation Cephalosporins (Gram-Pos coverage	If Anaphylactic PCN allergy	Aminoglycoside (Gram-Pos coverage)	Piperacillin/ Tazobactam (Broad- Spectrum Gram- Positive and Neg	
	Celazolili	Cinidaniyen	Gentamicin	Coverage)	
Wound < 1 cm; minimal contamination or soft tissue damage	< 50 kg: 2 gm q8 hr 50-100 kg: 2 gm q8 hr > 100 kg: 3 gm q8 hr	< 80 kg: 600 mg q8 hr > 80 kg: 900 mg q8 hr			
Wound 1-10 cm; moderate soft tissue damage; comminution of fracture	< 50 kg: 2 gm q8 hr 50-100 kg: 2 gm q8 hr > 100 kg: 3 gm q8 hr	< 80 kg: 600 mg q8 hr > 80 kg: 900 mg q8 hr			
Severe soft-tissue damage and substantial contamination with associated vascular injury	< 50 kg: 2 gm q8 hr 50-100 kg: 2 gm q8 hr > 100 kg: 3 gm q8 hr	< 80 kg: 600 mg q8 hr > 80 kg: 900 mg q8 hr	Loading dose in ER: Child<50 kg: 2.5 mg/kg Adult: 5 mg/kg		
Farmyard, soil or standing water., irrespective of wound size or severity				< 100 kg: 3.375 gm q6 hr > 100 kg: 4.5 gm q6 hr	

BILATERAL FEMUR FRACTURES = HIGHER MORTALITY

<u>Ca</u>	opeland, 1998	<u>O'Toole, 2014</u>	
Bilateral	26%	7%	
Unilateral	12%	2%	















AVOID CT PRIOR TO TRANSFER



- Retrospective review over 2 years
- 249 trauma patients
- No change in Injury Severity Score
- Delayed transfer by <u>90 minutes</u>

Quick, 2013

- Retrospective review over 3 months
- In-House Interpretation of outside images
 - 223 total CT scans
 - 25 repeat CT scans
 - \$4,592 lower cost per patient
 - Outside hospital interpretation
 - 320 total CT scans
 - 62 repeat CT scans

ABC-SBARTEMPLATE FOR TRANSFER OF PATIENTS

Airway, Breathing and Circulation

· Identify problems and perform interventions

Situation

- Patient name and age
- Referring physician name
- Reporting nurse name
- Indication for transfer
- IV access site, fluid and rate
- Other interventions completed

Background

- Event history
- AMPLE assessment
- Blood products
- Medications given (date and time)
- Imaging performed

Splinting

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Assessment

- Vital signs
- Pertinent physical exam findings
- Patient response to treatment

Recommendation

- Transport mode
- Level of transport care
- Medication intervention during transport
- Needed assessments and interventions



Ball CG, Jafri SM, Kirkpatrick AW, et al. Traumatic urethral injuries: Does the digital rectal examination really help us? *Injury*. 2009;40(9):984-986.

Cancio LC. Initial assessment and fluid resuscitation of burn patients. Surg Clin North Am. 2014;94(4):741-754.

Carcillo JA. Intravenous fluid choices in critically ill children. Curr Opin Crit Care. 2014;20(4):396-401.

Carney N, Totten AM, O'Reilly C, et al. Guidelines for the management of severe traumatic brain injury, fourth edition. *Neurosurgery*. 2017;80(1):6-15.

Chidester SJ, Williams N, Wang W, Groner JI. A pediatric massive transfusion protocol. *J Trauma Acute Care Surg.* 2012;73(5):1273-1277.

Cohen DB, Rinker C, Wilberger JE. Traumatic brain injury in anticoagulated patients. J Trauma. 2006;60(3):553-557.

Compton J, Copeland K, Flanders S, et al. Implementing SBAR across a large multihospital health system. *Jt Comm J Qual Patient Saf.* 2012;38(6):261-268.

Cothren CC, Osborn PM, Moore EE, Morgan SJ, Johnson JL, Smith WR. Preperitoneal pelvic packing for hemodynamically unstable pelvic fracture: A paradigm shift. *J Trauma*. 2007;62(4):834-839.

CRASH-2 collaborators, Roberts I, Shakur H, et al. The importance of early treatment with tranexamic acid in bleeding trauma patients: An exploratory analysis of the CRASH-2 randomized controlled trial. *Lancet*. 2011;377(9771):1096-1101.

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REFERENCES

Dehmer JJ, Adamson WT. Massive transfusion and blood product use in the pediatric trauma patient. Semin Pediatr Surg. 2010;19(4):286-291.

Dressler AM, Finck CM, Carroll CL, Bonanni CC, Spinella PC. Use of a massive transfusion protocol with hemostatic resuscitation for severe intraoperative bleeding in a child. *J Pediatr Surg.* 2010;45(7):1530-1533.

Gunst M, Ghaemmaghami V, Gruszecki A, et al. Changing epidemiology of trauma deaths leads to a bimodal distribution. *Proc (Bayl Univ Med Cent)*. 2010;23(4):349-354.

Hadley MN, Walters BC, Aarabi B, et al. Clinical assessment following acute cervical spinal cord injury. *Neurosurgery*. 2013;72(Suppl 2):40-53.

Hendrickson JE, Shaz BH, Pereira G, et al. Coagulopathy is prevalent and associated with adverse outcomes in transfused pediatric trauma patients. *J Pediatr.* 2012;160(2):204-209.

Hendrickson JE, Shaz BH, Pereira G, et al. Implementation of a pediatric trauma massive transfusion protocol: One institution's experience. *Transfusion*. 2012;52(6):1228-1236.

Holcomb JB, del Junco DJ, Fox EE, et al. The prospective, observational, multicenter, major trauma transfusion (PROMMTT) study: Comparative effectiveness of a time-varying treatment with competing risks. *JAMA Surg.* 2013;148(2):127-136.

Hurlbert J, Hadley MN, Walters BC, et al. Pharmacological therapy for acute spinal cord injury. *Neurosurgery*. 2013;72(Suppl 2):93-105.

Inaba K, Branco BC, Eckstein M, et al. Optimal positioning for emergent needle thoracostomy: A cadaver-based study. *J Trauma*. 2011;71(5):1099-1103.

REFERENCES

Inaba K, Lustenberger T, Recinos G, et al. Does size matter? A prospective analysis of 28–32 versus 36–40 French chest tube size in trauma. *J Trauma Acute Care Surg.* 2012;72(2):422-427.

Inaba K, Nosanov L, Menaker J, et al. Prospective derivation of a clinical decision rule for thoracolumbar spine evaluation after blunt trauma: An American Association for the Surgery of Trauma multi-institutional trials group study. *J Trauma*. 2015;78(3):459-465.

Ley E, Clond M, Srour M, et al. Emergency department crystalloid resuscitation of 1.5 L or more is associated with increased mortality in elderly and nonelderly trauma patients. *J Trauma*. 2011;70(2):398-400.

Min L, Burruss S, Morley E, et al. A simple clinical risk nomogram to predict mortality-associated geriatric complications in severely injured geriatric patients. *J Trauma Acute Care Surg.* 2013;74(4):1125-1132.

Mutschler M, Nienaber U, Brockamp T, et al. Renaissance of base deficit for the initial assessment of trauma patients: A base deficit-based classification for hypovolemic shock developed on data from 16,305 patients derived from the TraumaRegister DGU[®]. *Crit Care*. 2013;17(2):R42.

Neff NP, Cannon JW, Morrison JJ, Edwards MJ, Spinella PC, Borgman MA. Clearly defining pediatric mass transfusion: Cutting through the fog and friction using combat data. *J Trauma Acute Care Surg*. 2014;78(1):21-28.

Onzuka J, Worster A, McCreadie B. Is computerized tomography of trauma patients associated with a transfer delay to a regional trauma centre? *CJEM*. 2008;10(3):205-208.

Osborn PM, Smith WR, Moore EE, et al. Direct retroperitoneal pelvic packing versus pelvic angiography:A comparison of two management protocols for haemodynamically unstable pelvic fractures. *Injury*. 2009;40(1):54-60.

REFERENCES

O'Toole RV, Lindbloom BJ, Hui E, et al. Are bilateral femoral fractures no longer a marker for death? J Orthop Trauma. 2014;28(2):77-81.

Quick JA, Bartels AN, Coughenour JP, et al. Trauma transfers and definitive imaging: Patient benefit but at what cost? Am Surg. 2013;79(3):301-304.

Roberts D, Leigh-Smith S, Faris P, et al. Clinical presentation of patients with tension pneumothorax: A systematic review. Ann Surg. 2015;261(6):1068-1078.

Schmitt SK, Sexton DJ, Baron EL. Treatment and prevention of osteomyelitis following trauma in adults. UpToDate. <u>www.uptodate.com/contents/treatment-and-prevention-of-osteomyelitis-following-trauma-in-adults</u>. Accessed April 12, 2018.

Shrestha B, Holcomb JB, Camp EA, et al. Damage-control resuscitation increases successful nonoperative management rates and survival after severe blunt liver injury. *J Trauma*. 2015;78(2):336-341.

Snyder D, Tsou A, Schoelles K. Efficacy of prehospital application of tourniquets and hemostatic dressings to control traumatic external hemorrhage. Washington, DC: National Highway Traffic Safety Administration; May 2014.

Steinhausen E, Lefering R, Tjardes T, et al. A risk-adapted approach is beneficial in the management of bilateral femoral shaft fractures in multiple trauma patients: An analysis based on the trauma registry of the German Trauma Society. *J Trauma*. 2014;76(5):1288-1293.

Sussman M, DiRusso SM, Sullivan T, et al. Traumatic brain injury in the elderly: Increased mortality and worse functional outcome at discharge despite lower injury severity. *J Trauma*. 2002;53(2):219-224.

REFERENCES

United Nations, Department of Economic and Social Affairs, Population Division (2015). World Population Ageing. Available at: <u>www.un.org/esa/population/publications/worldageing19502050/</u>. Accessed April 12, 2018.

Walters BC, Hadley MN, Hurlbert RJ, et al. Guidelines for the management of acute cervical spine and spinal cord injuries. *Neurosurgery*. 2013;60(Suppl 1):82-91.

Washington CW, Grubb RL, Jr. Are routine repeat imaging and intensive care unit admission necessary in mild traumatic brain injury? *J Neurosurg.* 2012;116(3):549-557.

Wilkerson RG, Stone MB. Sensitivity of bedside ultrasound and supine anteroposterior chest radiographs for the identification of pneumothorax after blunt trauma. Acad Emerg Med. 2010;17(1):11-17.