

Letter to the editor: An ounce of prevention . . .

Robert D. Barraco MD, MPH
Lehigh Valley Health Network, robert_d.barraco@lvhn.org

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Pan-Computed Tomography for Blunt Trauma Patients May Be Overused

To the Editor:

We read with interest the article by Tillou et al.¹ "Is the use of Pan-Computed Tomography (CT) for Blunt Trauma Justified? A Prospective Evaluation" in October 2009, *Journal of Trauma*. The issue of radiation-induced injury is an extremely germane topic to the practicing surgeon in the year 2009. There are a few additional observations that we would like to make based on the results of this study.

The control group for this study was the emergency department physicians versus trauma surgeons. The latter deal more often with severely injured patients and may be in a better position to make the clinical judgment of what CT scan is necessary. Of the total 443 blunt trauma patients, 284 (64%) were determined to need pan-CT scan as a part of the initial evaluation by the trauma surgeon. The information about the other 36% of patients who did not undergo pan-CT scan by the trauma surgeon and their outcome would be highly valuable to be included in the study.

The study reported that trauma surgeons supported the scans not only based on the signs of injury but also based on the risk of injury. We assume that the "risk of injury" is analogous to mechanism of injury. Thus, it will be useful to know the mechanism of injury for those patients whose injuries would have been missed if they did not have a pan-CT scan. It is also noteworthy that roughly 60% of the scans obtained in the study for signs of injury and 82% of the scans obtained for risk of injury without apparent symptoms were negative for injury.

The concern about radiation exposure risk and the increasing public awareness cannot be ignored.² It is a laudable goal to obtain pan-CT scan in approximately 10 patients and detect two injuries as opposed to obtaining pan-CT scan in approximately 100 patients to detect the same two injuries. Although we do ac-

knowledge that this is a lofty goal, the benefits of this approach are worth aiming for one pan-CT scan at a time. On the other hand, any trauma surgeon with even a modicum of experience will be able to tell stories of missed injuries due to inadequate work-up.

Finally, negative pan-CT scan does not always mean negative injuries (including incorrect interpretation by the radiologist) and may promote a false sense of security. For example, CT scan of the abdomen and pelvis is notoriously unreliable for bowel injuries and may require more clinical alertness and follow-up.

Lois U. Sakorafas, MD

Trauma, Critical Care, Acute Care Surgery
Director of Research, Trauma Center
Lancaster General Hospital
Lancaster, PA

Frederick B. Rogers, MD, MS, FACS

Trauma Program, Medical Director
Lancaster General Hospital
Lancaster, PA

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Damage Control Resuscitation Using Warm Fresh Whole Blood: A Paramount Role for Leukocytes and Derived Microparticles in the Prevention of Coagulation Abnormalities?

To the Editor:

We read with interest the article by Spinella et al.¹ using warm fresh whole blood (WFWB) transfusion in patients with severe life-threatening hem-

orrhagic traumatic injuries. The authors miss to discuss the paramount role of leukocytes and derived procoagulant microparticles in the restoration of normal coagulation process. Transfusing functional white blood cell is one of the singularities of the WFWB transfusion. Because both leukocytes and derived microparticles (MPs) shed on stimulation express functional tissue factor (TF), the primary initiator of blood coagulation and thrombus propagation,² it is likely that they might act as potent effectors of the coagulation process in WFWB transfused patients. During the past decade, selectins, leukocytes-derived MPs, and TF have merged into a determinant triad in thrombosis. More recently, several groups have established that the swift recruitment at the edge of the thrombus of leukocytes and leukocytes-derived MPs through P-selection/P-selectin glycoprotein ligand-1 interactions is mandatory for the thrombus growth.³ We have demonstrated the importance of inflammatory cells trapping (Fig. 1) together with the shedding of leukocytes-derived MPs harboring TF activities in the formation of the thrombus.⁴ Using a mice model of hemophilia A, Hrachovnova et al.⁵ demonstrated that the infusion of P-selectin prompts the shedding of leukocytes-derived MPs harboring TF that correct the bleeding phenotype. In another clinical setting (septic shock), a beneficial effect of microparticles was recently suggested by Soriano et al.⁶ Indeed, in their study, lower levels of endothelial, leukocyte, and platelet-derived MPs were associated with higher mortality rates and organ dysfunction. Microparticles may protect against vascular hyporeactivity by maintaining a tonic pressor response. This challenging hypothesis was supported by the demonstration that MPs isolated from patients with septic shock were able to prevent vascular hyporeactivity through Thromboxane A2 delivery. Taken together, we believe that part of the beneficial effect of the WFWB strategy could be explained by the additional transfusion of leukocytes and leukocyte-derived MPs that are mandatory to restore efficient vascular homeostasis.

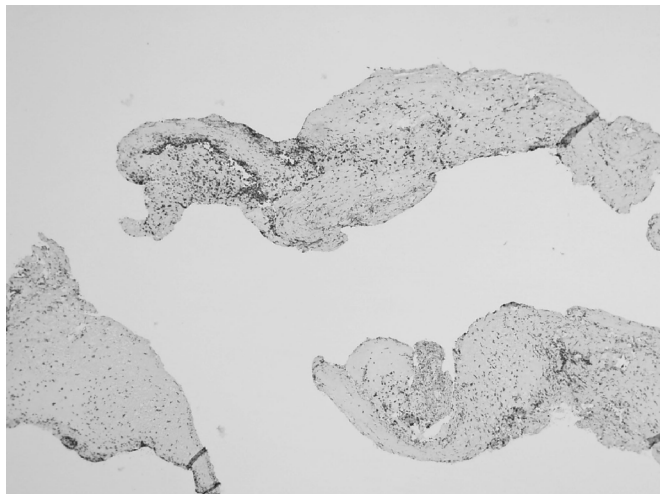


Figure 1. Leukocyte infiltrate within thrombus. Monocytes were stained using anti-CD68.

Nicolas Morel, MD
François Delaunay, MD
Philippe Dabadie, MD, PhD
 Pôle des Urgences adultes, service de
 réanimation des Urgences
 Hôpital Pellegrin
 Bordeaux, France

Gerlinde Averous, MD
 Département d'Anatomie Pathologique
 Hôpital de Hautepierre
 Hôpitaux Universitaires de Strasbourg
 Strasbourg, France

Olivier Morel, MD, PhD
 Pôle d'activité médico-chirurgicale des
 Hôpitaux Universitaires de Strasbourg
 Nouvel Hôpital Civil
 Université de Strasbourg
 Strasbourg, France

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The Author's Reply:

We thank Drs. Nicolas Morel, Gerlinde Averous, and Olivier Morel for their comments. We agree that leukocyte-derived microparticles may have also been another mechanism that can explain the association we measured between fresh whole blood use and improved survival in combat casualties with severe traumatic injuries. In our study, both patient groups also received a significant number of red blood cell (RBC) units of prolonged storage (mean, 33 days), which have also been reported to generate procoagulant microparticles^{1,2} and have been associated with increased risk of deep venous thromboses in critically ill civilian trauma patients.³ Therefore, one interesting question that their letter generates is “are microparticles from white blood cells (WBCs) more prothrombotic than those from RBCs?” Additional questions are, how long does the procoagulant properties of microparticles persist, and once bleeding has stopped and patients become at risk for thrombotic adverse events, can methods such as thromboelastography detect hypercoagulability

and then be used to direct or titrate anti-coagulant or antiplatelet agents to prevent these adverse events from occurring? The study of the microparticles from fresh whole blood and all stored blood components (RBCs, white blood cells, plasma, and platelets) to determine their thrombotic and immune modulating properties including their effect on endothelial surfaces is required.

Philip C. Spinella, MD

Pediatric Intensivist, Department of
 Pediatrics
 Medical Director Surgical Critical Care,
 Department of Surgery
 Connecticut Children's Medical Center
 Hartford, CT
 Associate Professor, University of
 Connecticut
 Consultant, Blood Research Program
 US Army ISR
 San Antonio, TX

John B. Holcomb, MD

Vice Chair and Professor of Surgery
 Chief, Division of Acute Care Surgery
 Director, Center for Translational Injury
 Research
 Jack H. Mayfield, M.D. Chair in Surgery
 University of Texas Health Science Center
 Houston, TX

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Letter to the Editor: An Ounce of Prevention . . .

To the Editor:

Trauma surgeons have always been thought of as the final common pathway of the injured patient. The road from there forks to those we can save and those we cannot. Through the years, film and screen representations of our specialty have included fictional television shows such as MASH and Emergency and reality shows such as Trauma: Life and Death in the ER and Critical Hour. These are certainly reflective of

our clinical work. But is that all there is to us, $N = 1$?

I would argue there is much more. Prevention expands the scope of duty of the trauma surgeon outside the hospital walls to the community that is the basis for the trauma system. $N = 1$ becomes $N =$ hundreds of thousands. A trauma surgeon can only influence one patient's life at a time. A trauma surgeon active in prevention efforts in his or her community can influence thousands. The most rewarding patient for a trauma surgeon should be the one they do not see because they have prevented the injury. One may ask what makes this rewarding, and are there any relative value units associated with prevention efforts? Patients not having to endure life-changing disability and families not having to live through devastating loss should be incentive enough. Undoubtedly, somewhere there has been or can be a cost-effectiveness analysis performed that compares the cost to society of treating an injured patient versus the cost to prevent even one such injury. There are also opportunity costs to the hospital itself for the room occupied by such a patient. In the end, I am certain these efforts of prevention would be among the most effective activities we undertake.

The community is ripe for our involvement. There are many organizations that would receive our participation with open arms. Because I started engaging in such efforts, the opportunities for change have grown. Have I seen results? Yes, in different ways. Our distracted driving intervention clearly changed behavior on observing driving habits firsthand of high school students. These data have been reported at various meetings in 2009 and 2010. Television and online segments on injury prevention have been among the most viewed on our local news program's website.

The American College of Surgeons Committee on Trauma has recognized the importance of injury prevention. The position of prevention coordinator has been recognized as part of the optimal care of the trauma patient. Prevention coordinators have not yet been mandated but that likely will come in due time.

Ultimately, it is up to us as trauma surgeons how involved we and our

trauma programs want to become. I think we have an ethical obligation to the community we serve to engage fully in prevention efforts. To do otherwise would be a conflict of interest, allowing more residents of our communities to become trauma patients and subject to our fees for service. Again, the most rewarding patient for a trauma surgeon should be the one not seen because the injury, the disability, and the death have been prevented. It is not merely the right thing to do; it is the only thing to do.

Robert D. Barraco, MD, MPH

Division of Trauma/Surgical Critical Care
Department of Surgery
Lehigh Valley Health Network
Allentown, Pennsylvania

Live Tissue: Ideal for Trauma Training?

To the Editor:

Alternative clinical training methods that are relevant to current times need to be identified. Patients can no longer be used as training subjects, yet adequate practical clinical exposure is vital to develop safe, competent, and independent clinicians of the next generation. These principles of competency and experience especially apply to trauma patients who, as the sickest of patients, require life-altering decisions to be made rapidly about their care by experienced clinicians in challenging circumstances. Only through regular practice and experience, can trainee clinicians acquire the skill set necessary to treat these patients appropriately.

The US military regularly use the live tissue model in combat-related trauma training courses for military personnel prior to deployment in combat zones.¹ These models are ideal for them to gain appropriate practical experience before deployment.

Live tissue training has also been used for endoscopy training and the practice of associated techniques. Barthet et al.² demonstrated significantly increased competence using live liver tissue in performing diagnostic procedures with regard to visualising anatomic structures, performance of fine needle aspiration, and, to a lesser extent,

endoscopic ultrasound-guided coeliac neurolysis (endoluminal ultrasound).

Considering the vast experience available, it could therefore be an ideal modality for civilian trauma training. Trainees would appreciate traumatic injuries for real rather than merely supposition or imagination (such as in Advanced Trauma Life Support and other courses that use manikins). Real vascular injuries allow trainees opportunities to perform various techniques that respond authentically to injuries they realistically encounter during clinical practice; an advantage of the Advanced Trauma Operative Management course that uses the live tissue porcine model. This methodology has been shown to be greatly beneficial to trainees.^{3,4} Trainees can develop operative trauma management skills (not normally experienced during their routine training). Although useful, cadaveric courses are limited in that they do not accurately achieve the same texture and tissue handling capabilities compared with live humans: an advantage of live tissue. Trainees must undergo rigorous training to ensure patient safety, which can only be achieved by training on a suitable model.

An additional benefit is the pathophysiologic response to traumatic injuries that live tissue provides and the appropriate physiologic response of the patient that is observed according to the trainee's interventions/clinical management. This objective cannot be accurately reflected using simulators or other training modalities.

Live tissue appears to be the most suitable modality for training civilian trauma clinicians and could be considered as an effective adjunct to trauma training simulation scenarios.

Matthew G. Reeds, MBChB, MRCS

Department of Surgery
Nottingham University Hospitals
Nottingham, United Kingdom

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Clinical Examination in Complement With Computed Tomography Scan: An Effective Method for Identification of Cervical Spine Injury

To the Editor:

I read the article of Gonzalez et al.¹ with great enthusiasm. I first agree with the two general tenets of Gonzalez, which deserve a wide public acknowledgment in that: (1) clinical clearance (CC) in most cases is very reliable; and if clinicians use it more, and rely less on a computed tomography, a significant national health care cost can be reduced; (2) The role of distracting injury against CC has been exaggerated (at least in the literature), has lacked a clear and consistent definition, and has created a false impression among clinicians, which has led to a false practice. However, I would also like to make a few comments.

First, the authors did not mention or comment on a recent article by Duane et al.² that suggested a false-negative rate of CC to be significant and may be as high as 13%. Whether these computed tomography findings that CC missed had any clinical implications remains to be proven. But, despite how confident we are that CC may be reliable, false negativity does still exist, and probably exists at a higher rate than what the authors have reported of 0.2%. What is absent in both the study of Duane et al. and Gonzalez et al. was any extended clinical follow-up that may have better clarified the significance of the radiographic study and reassured us that we were not just a victim of medical investigative technology.³

Second, what is not apparent but should be considered is the effect that age and injury mechanism may have on CC. An elderly patient with a high C1-C2 fracture may lack the neck pain and clinical finding, as demonstrated in Duane et al. and in my own personal anecdote. In Stiell et al.⁴ quoted by Gonzalez et al., age was recognized as a risk factor and actually was used to triage who qualified for CC. Similarly, my recent study⁵ has suggested that an injury mechanism of motor vehicle collision with a rollover may predispose the patient to cervical spine injury, and this fact was further supported by recent Thompson et al.⁶ analysis of their Canadian C-spine Rule patients. Gonzalez et al. stated that the distracting injury was always present in the patients seen at the level I trauma center because of the nature of the severity, but the severity of injury of each level I trauma center is not always equal. It would be informative if Gonzalez et al. can also provide the Injury Severity Score, which would reflect the impact of injury mechanism seen at his institution.

In conclusion, I truly applaud the authors' work and contribution to the field. I do draw some caution that CC may be imperfect whether it has any clinical significance. Age and certainly biomechanism deserve further study.

Narong Kulvatunyou, MD

Department of Surgery
Section Trauma, Critical Care, and Acute
Care Surgery
University of Arizona Health Science
Center
Tucson, Arizona

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The Role of MRI in the Clearance of the Cervical Spine in the Obtunded Blunt Trauma Patient

To the Editor:

I read with interest the meta-analysis by Schoenfeld et al.¹ in the January 2010 issue of the *Journal of Trauma*. The optimal method of clearance of the cervical spine in the obtunded blunt trauma patient with gross movement of the extremities and a negative computed tomography (CT) remains controversial. However, the results reported in this meta-analysis regarding operative intervention on trauma patients with a negative CT may not be applicable to the obtunded patient.

The authors report a total of 12 patients who received operative intervention on the cervical spine because of a positive magnetic resonance imaging in patients with a negative CT. Of these, nine were taken from the study by Sarani et al.²; however, none of these patients were obtunded. In addition, the patient who required operation in the Adams et al.³ study had surgery for a T7 Chance fracture and not for a cervical spine fracture.

This leaves the two patients in the Menaker et al.⁴ study as the only obtunded blunt trauma patients with a negative CT and gross extremity movement in the literature to have required cervical spine stabilization. Consideration of only the obtunded patients in this meta-analysis leaves 2 patients of 1,085 who received operative intervention or 0.2%. More detailed information about these two patients would be of interest.

John J. Como, MD

Division of Trauma, Critical Care, and Burns
Department of Surgery
MetroHealth Medical Center
Cleveland, Ohio

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Response to “Pulseless Electrical Activity Focused Abdominal Sonography for Trauma, and Cardiac Contractile Activity as Predictors of Survival After Trauma”

The Author's Reply:

We read with interest the letter written in response to our article entitled “Pulseless electrical activity focused abdominal sonography for trauma, and cardiac contractile activity as predictors of survival after trauma.”¹ We agree that ultrasound will likely have an increased role in resuscitation after cardiac arrest for all causes. We also agree that the data to support the addition of ultrasound to trauma resuscitation protocols in the case of pulseless electrical activity (PEA) are lacking at this time and that producing adequately powered studies will be difficult. Similar to many centers, we continue to collect data and assess our performance in treating these often difficult patients. Ultrasound has the ability to potentially identify patients with a reasonable chance of survival and to potentially identify immediately correctable causes of PEA. Regarding the

role of resuscitative thoracotomy for PEA with cardiac activity, ultrasound should identify the subset of patients who have tamponade and may benefit from emergency thoracotomy. Whether resuscitative thoracotomy for PEA in the absence of tamponade is indicated in blunt trauma patients with organized cardiac activity is unknown at this time and would likely depend on the underlying etiology of the PEA.

Kevin M. Schuster, MD

Yale University School of Medicine
New Haven, Connecticut

Kimberly A. Davis, MD

Yale University School of Medicine
New Haven, Connecticut

REFERENCE

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Blunt Trauma and Routine Cervical X-Ray

To the Editor:

Nowadays, managing trauma patients is based on preexisting protocols. However, it is necessary to reassess the protocols for managing blunt trauma patients to eliminate possible diagnostic interventions that may be safely eliminated.¹ Reviewing the literature, several studies have indicated routine use of cervical X-ray to detect cervical spine injury in blunt trauma patients. We read article entitled “Routine cervical spine radiography for trauma victims: Does everybody need it?”² with great interest. We greatly support the idea stated by Michael J. R. Edwards. We have a similar experience about managing blunt trauma patients in our center, which is the trauma referral center in the south of Iran to which approximately 30,000 blunt trauma patients are admitted annually. Most of them are involved in high energy accidents with multiple organ injuries. We don't have a routine protocol to do cervical X-ray in all blunt trauma patients. In our center, indications for requesting cervical X-

ray (in anteroposterior and lateral views) include

1. Patients with Glasgow Coma Scale score <15.
2. Patients who have pain on cervical spine.
3. Patient who have limitation of motion of cervical spine.
4. Tenderness on spinous process of cervical spine on physical examination.
5. Uncooperative patients.

Computed tomography scan of cervical spine is indicated in the following situations:

1. Abnormal cervical spine X-ray.
2. Having pain, tenderness, or limitation of motion regardless of normal X-ray.

This protocol is based on the fact that in the awake and alert blunt trauma patients, physical examination defines the need for a cervical X-ray. This protocol improved our health system money expenditure, especially important in trauma referral centers in developing countries where a large number of high energy accidents occur annually. Moreover by using this protocol of admission, patients who are not at risk for cervical injury can be discharged more quickly. The aim of writing this letter is to say that cervical X-ray in awake and alert blunt trauma patients should be requested on the basis of clinical findings.

Shahram Paydar, MD

Rooollah Salahi, MD

Shahram Bolandparvaz, MD

Hamid Reza Abbasi, MD

Heshmatollah Salahi, MD

General Surgery Department
Trauma Research Center
Shiraz University of Medical Sciences
Shiraz, Iran

REFERENCES

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