

A Disciplined Approach to Implementation of Evidence-Based Practices Decreases ICU and Hospital Length of Stay in Traumatically Injured Patients

John P. Kepros MD,MBA

SPARROW

Objectives

- Outline the performance improvement format used over the last 7 years by the Sparrow trauma service line
- Characterize the depth and extent of the commitment to evidence based practices in our trauma service line
- Explicate the interaction identified between process and outcome in our service line

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Trauma Overview and Perspective

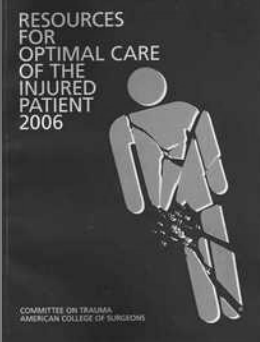
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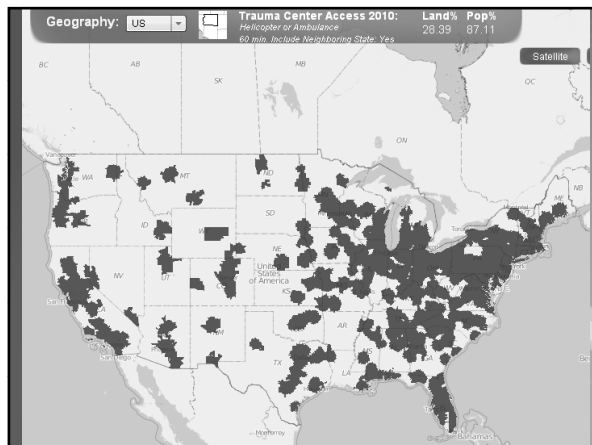
Cook County-1966-First Trauma Center



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Sparrow Trauma Performance Improvement

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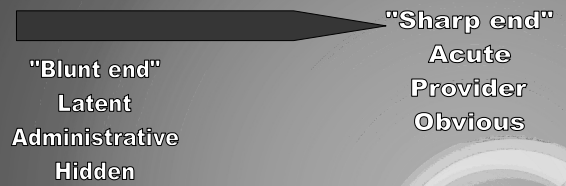
Formula Trauma™

Bad Apple Theory (Old View)



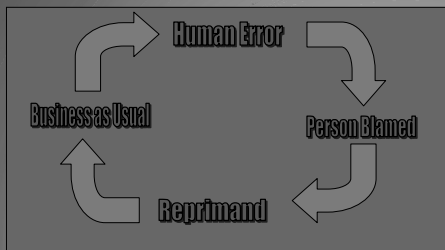
SAFETY

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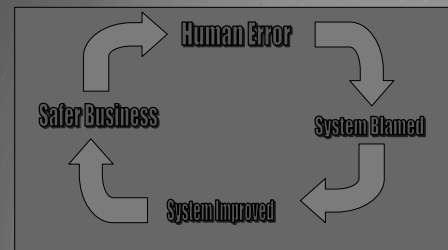
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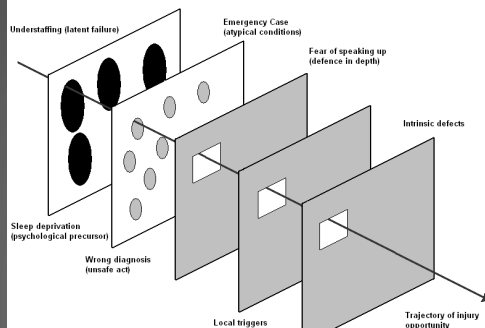
"Small changes can produce big results...but the areas of highest leverage are often the least obvious."

Peter Senge
The Fifth Discipline

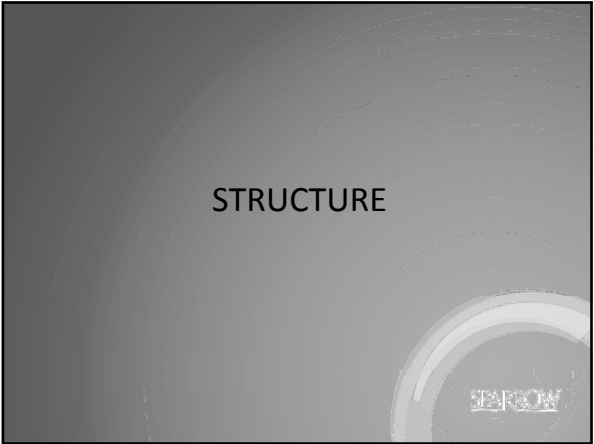


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THE NEW ENGLAND JOURNAL OF MEDICINE

SPECIAL ARTICLE

A National Evaluation of the Effect of Trauma-Center Care on Mortality

Ellen J. MacKenzie, Ph.D., Frederick P. Rivara, M.D., M.P.H., Gregory J. Jurkovich, M.D., Avery B. Nathens, M.D., Ph.D., Katherine P. Frey, M.P.H., Brian L. Eggleston, M.P.P., David S. Salkever, Ph.D., and Daniel O. Scharfstein, Sc.D.

CONCLUSIONS
Our findings show that the risk of death is significantly lower when care is provided in a trauma center than in a non-trauma center and argue for continued efforts at regionalization.

N ENGL J MED 354:4 WWW.NEJM.ORG JANUARY 26, 2006

TRAUMA SYSTEMS

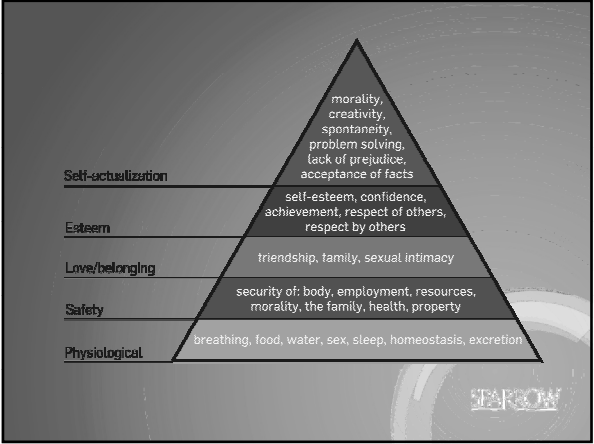
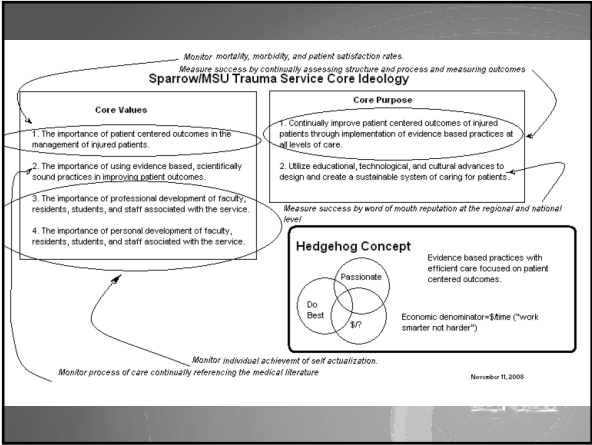
ORIGINAL RESEARCH | IMPROVING PATIENT CARE

What Distinguishes Top-Performing Hospitals in Acute Myocardial Infarction Mortality Rates?

A Qualitative Study

Leslie A. Curry, PhD; Erica Spatz, MD; Emily Cherlin, PhD, MSW; Jennifer W. Thompson, MPP; David Berg, PhD; Henry H. Ting, MD, MBA; Carole Decker, RN, PhD; Harlan M. Krumholz, MD, SM; and Elizabeth H. Bradley, PhD

Conclusion: High-performing hospitals were characterized by an organizational culture that supported efforts to improve AMI care across the hospital. Evidence-based protocols and processes, although important, may not be sufficient for achieving high hospital performance in care for patients with AMI.



Penny Stevens PhD

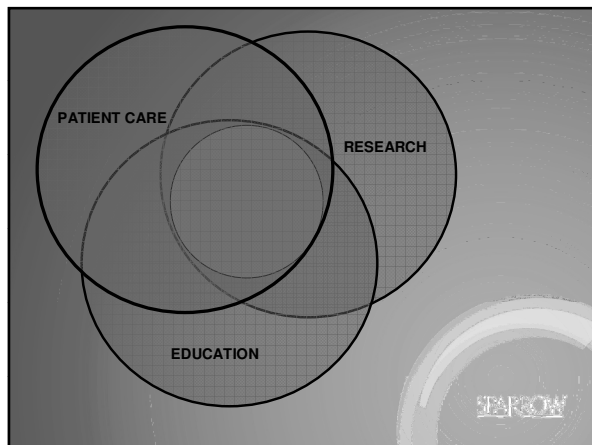


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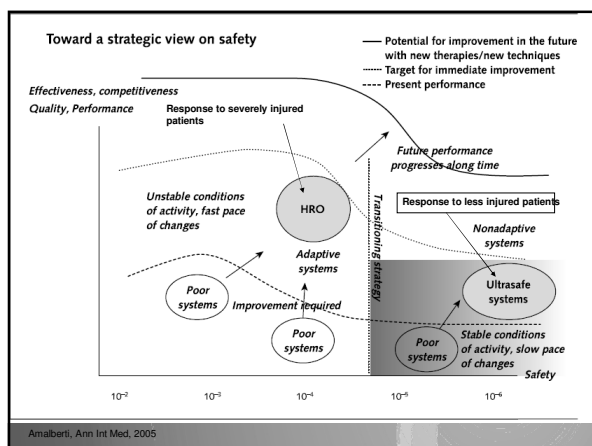
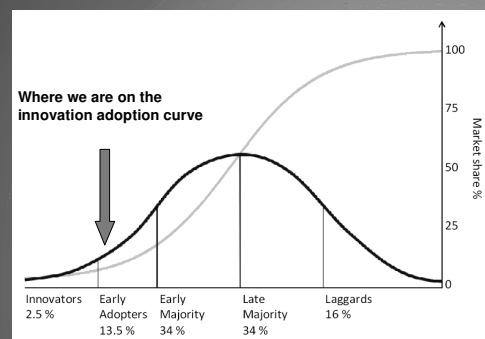
John Kepros MD



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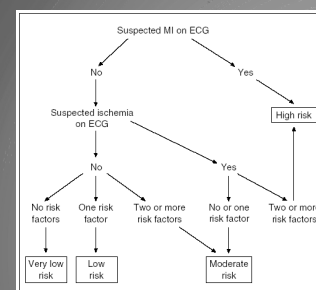


Synergy of Patient Care, Research, and Education



PREDICTION OF THE NEED FOR INTENSIVE CARE IN PATIENTS WHO COME TO EMERGENCY DEPARTMENTS WITH ACUTE CHEST PAIN

LEE GOLDMAN, M.D., E. FRANCIS COOK, Sc.D., PAULA A. JOHNSON, M.D., DONALD A. BRAND, Ph.D., GREGORY W. ROUAN, M.D., AND THOMAS H. LEE, M.D.



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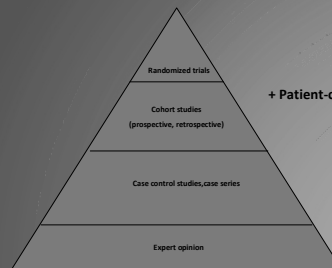
EAST redesigned

Check out our new website and mobile practice management guidelines.



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Hierarchy of Evidence



+ Patient-centered outcome

If there is not high-level evidence, we should try to find several sources of supporting evidence.

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FACT SHEET

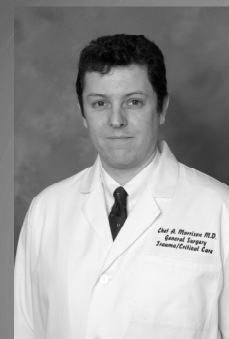
THE LEAPFROG GROUP
for Patient Safety
Rewarding Higher Standards
March 2005

- **Computer Physician Order Entry (CPOE):** With CPOE systems, hospital staff enter medication orders via computer linked to prescribing error prevention software. CPOE has been shown to reduce serious prescribing errors in hospitals by **more than 50%**.
- **Evidence-Based Hospital Referral (EHR):** Consumers and health care purchasers should choose hospitals with extensive experience and the best results with certain high-risk surgeries and conditions. By referring patients needing certain complex medical procedures to hospitals offering the best survival odds based on scientifically valid criteria — such as the number of times a hospital performs these procedures each year or other process or outcomes data — research indicates that a patient's risk of dying could be reduced by **40%**.
- **ICU Physician Staffing (IPS):** Staffing ICUs with doctors who have special training in critical care medicine, called 'intensivists', has been shown to reduce the risk of patients dying in the ICU by **40%**.
- **The Leapfrog Safe Practices Score - The National Quality Forum's 27 Safe Practices:** The National Quality Forum-endorsed 30 Safe Practices cover a range of practices that, if utilized, would reduce the risk of harm in certain processes, systems or environments of care. Included in the 30 practices are the original 3 Leapfrog leaps. For this new leap, added in April 2004, hospitals' progress on the remaining 27 safe practices will be assessed.

ICU

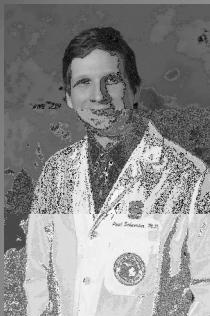
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Chet Morrison MD



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Paul Schneider MD



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PROCESS

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Technical Knowledge

Adaptive Knowledge

TECHNICAL PROBLEMS VS. ADAPTIVE CHALLENGES

The single biggest failure of leadership is to treat adaptive challenges like technical problems.

TECHNICAL PROBLEMS	ADAPTIVE CHALLENGES
1. Easy to identify	1. Difficult to identify (easy to deny)
2. Often lend themselves to quick and easy (cut-and-dried) solutions	2. Require changes in values, beliefs, roles, relationships, & approaches to work
3. Often can be solved by an authority or expert	3. People with the problem do the work of solving it
4. Require change in just one or a few places; often contained within organizational boundaries	4. Require change in numerous places; usually cross organizational boundaries
5. People are generally receptive to technical solutions	5. People often resist even acknowledging adaptive challenges
6. Solutions can often be implemented quickly—even by edict	6. "Solutions" require experiments and new resources; they can take a long time to implement and cannot be implemented by edict

EXAMPLES

- Take medication to lower blood pressure
- Implement electronic ordering and dispensing of medications in hospitals to reduce errors and drug interactions
- Increase penalty for drunk driving
- Change lifestyle to eat healthy, get more exercise and lower stress
- Encourage nurses and pharmacists to question and even challenge illogical or dangerous prescriptions by physicians
- Raise public awareness of the dangers and effects of drunk driving, targeting teenagers in particular

Adapted from Senge, Scharmer & Smith, 2008, "The Work of Leadership," Harvard Business Review January/February 2007, and Senge & Scharmer, 2008, published by the Harvard Business School Press, 2008

The Journal of **TRAUMA**[®] Injury, Infection, and Critical Care

Trauma Team Oversight Improves Efficiency of Care and Augments Clinical and Economic Outcomes

Kimberly A. Davis, MD, FACS, Nicole C. Cabhad, BS, Kevin M. Schuster, MD, Lewis J. Kaplan, MD, Carla Carusone, RN, Tucker Leary, MBA, and Robert Udelson, MD, MBA

Background: The purpose of this study was to determine whether trauma team oversight of patient management would positively affect efficiency of care as defined by improved patient throughput, with augmentation of both clinical and economic outcomes.

Methods: All patients activating the trauma team at a level I trauma center during two time periods (last 6 months of 2005 and 2006) were reviewed. Trauma team activation criteria remained constant across the two time periods. During period one, patients were admitted to multiple services depending on injury pattern, whereas in period two, most patients were admitted to the trauma service for trauma team oversight of their management. In period two, improved documentation and appropriate coding were encouraged.

Results: Patient demographics, number of full-time trauma surgeons, and payer mix were similar during the two time periods. Trauma activations increased 150% ($p < 0.05$). The percentage of patients admitted to the trauma service increased (68% vs. 86%; $p < 0.001$). Median injury severity score (ISS) of admitted patients was unchanged, although mean ISS decreased (15 ± 15 vs. 12 ± 11 ; $p < 0.0001$). Hospital length of stay decreased (12 ± 55 vs. 6 ± 11 ; $p < 0.0001$). Linear regression analysis identified ISS and admission during the later time period as significant predictors of decreased length of stay. Changes in billings and coding practices resulted in statistically significant increases in trauma surgeon work-related relative value units (182% increase), charges (360% increase), and collections (200% increase). The increased system efficiency resulted in significant decreases in the actual hospital costs per patient and led to the generation of an overall net positive hospital contribution margin per patient.

Conclusions: Implementation of trauma team oversight of patient care resulted in increased efficiency of care delivery, with shorter hospital lengths of stay despite increased patient volume. This paradigm change, coupled with improved documentation and coding, resulted in improved reimbursement for the physician, and lower cost per discharge for the hospital.

Key Words: Contribution margin, Remuneration, xRVUs, Outcomes, Trauma systems.

J Trauma. 2008;65:1238–1244.

TRAUMA SYSTEMS

The New England Journal of Medicine

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Volume 331 OCTOBER 27, 1994 Number 17

IMMEDIATE VERSUS DELAYED FLUID RESUSCITATION FOR HYPOTENSIVE PATIENTS WITH PENETRATING TORSO INJURIES

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Abstract **Background.** Fluid resuscitation may be detrimental when given before bleeding is controlled in patients with trauma. The purpose of this study was to determine the effects of delaying fluid resuscitation until the time of operative intervention in hypotensive patients with penetrating injuries to the torso.

Methods. We conducted a prospective trial comparing immediate and delayed fluid resuscitation in 598 adults with penetrating torso injuries who presented with a pre-hospital systolic blood pressure <90 mm Hg. The study setting was a city with a single centralized system of pre-hospital emergency care and a single receiving facility for patients with major trauma. Patients assigned to the immediate-resuscitation group received standard fluid resuscitation before they reached the hospital and in the trauma center, and those assigned to the delayed-resuscitation group received intravenous cannulation but no fluid resuscitation until they reached the operating room.

Results. Among the 289 patients who received delayed fluid resuscitation, 200 (70 percent) survived and were discharged from the hospital, as compared with 193 of the 309 patients (62 percent) who received immediate fluid resuscitation ($P = 0.04$). The mean estimated intra-operative blood loss was similar in the two groups. Among the 238 patients in the delayed-resuscitation group who survived to the postoperative period, 55 (23 percent) had one or more complications (adult respiratory distress syndrome, sepsis syndrome, acute renal failure, coagulopathy, wound infection, and pneumonia), as compared with 69 of the 227 patients (30 percent) in the immediate-resuscitation group ($P = 0.06$). The duration of hospitalization was shorter in the delayed-resuscitation group.

Conclusions. For hypotensive patients with penetrating torso injuries, delay of aggressive fluid resuscitation until operative intervention improves the outcome. (N Engl J Med 1994;331:1105-9.)

PREHOSPITAL

Effects of tranexamic acid on death, vascular occlusive events, and blood transfusion in trauma patients with significant haemorrhage (CRASH-2): a randomised, placebo-controlled trial

CRASH-2 trial collaborators*

Interpretation Tranexamic acid safely reduced the risk of death in bleeding trauma patients in this study. On the basis of these results, tranexamic acid should be considered for use in bleeding trauma patients.

www.thelancet.com Published online June 15, 2010 DOI:10.1016/S0140-6736(10)60835-5

ED

Effect of whole-body CT during trauma resuscitation on survival: a retrospective, multicentre study

Stefan Huber-Wagner, Ralf Lefering, Lars-Mikael Quick, Markus Körner, Michael V Kay, Klaus-Jürgen Pflafer, Maximilian Reiser, Wolf Mutschler, Ralf Georg Kienz, on behalf of the Working Group on Polytrauma of the German Trauma Society*

Interpretation Integration of whole-body CT into early trauma care significantly increased the probability of survival in patients with polytrauma. Whole-body CT is recommended as a standard diagnostic method during the early resuscitation phase for patients with polytrauma.

www.thelancet.com Published online March 24, 2009 DOI:10.1016/S0140-6736(09)60232-4

ED

THE NEW ENGLAND JOURNAL OF MEDICINE

SPECIAL ARTICLE

A Surgical Safety Checklist to Reduce Morbidity and Mortality in a Global Population

Alex B. Haynes, M.D., M.P.H., Thomas G. Weiser, M.D., M.P.H.,
William R. Berry, M.D., M.P.H., Stuart R. Lipsitz, Sc.D.,
Abdel-Hadi S. Breizat, M.D., Ph.D., E. Patchen Dellinger, M.D.,
Teodoro Herbosa, M.D., Sudhir Joseph, M.S., Pasquale L. Kibatala, M.D.,
Marie Carmela M. Lapitan, M.D., Alan F. Merry, M.B., Ch.B., F.A.N.Z.C.A., F.R.C.A.,
Krishna Moorthy, M.D., F.R.C.S., Richard K. Reznick, M.D., M.Ed., Bryce Taylor, M.D.,
and Atul A. Gawande, M.D., M.P.H., for the Safe Surgery Saves Lives Study Group*

CONCLUSIONS
Implementation of the checklist was associated with concomitant reductions in the rates of death and complications among patients at least 16 years of age who were undergoing noncardiac surgery in a diverse group of hospitals.

N ENGL J MED 360:5 NEJM.ORG JANUARY 29, 2009

OR

The American Journal of Surgery (2009) 197, 565-570

The American Journal of Surgery

The North Pacific Surgical Association

A high ratio of plasma and platelets to packed red blood cells in the first 6 hours of massive transfusion improves outcomes in a large multicenter study

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KEYWORDS:
Traumatic hemorrhagic shock; Massive transfusion; Transfusion ratios; Coagulopathy of trauma

Abstract
BACKGROUND: In trauma, most hemorrhagic deaths occur within the first 6 hours. This study examined the effect on survival of high ratios of fresh frozen plasma (FFP) and platelets (PLTs) to packed red blood cells (PRBCs) in the first 6 hours.
METHODS: Records of 466 massive transfusion trauma patients (≥ 10 U of PRBCs in 24 hours) at 16 level I trauma centers were reviewed. Transfusion ratios in the first 6 hours were correlated with outcome.
RESULTS: All groups had similar baseline characteristics. Higher 6-hour ratios of FFP:PRBCs and PLTs:PRBCs lead to improved 6-hour mortality (from 37.3 [in the lowest ratio group] to 15.7 [in the middle ratio group] to 2.9% [in the highest ratio group] and 22.8% to 94.0% to 3.2%, respectively) and in-hospital mortality (from 54.9 to 41.1 to 25.5% and 43.7% to 46.8% to 27.4%, respectively). Initial higher ratios of FFP:PRBCs and PLTs:PRBCs decreased overall PRBC transfusions.
CONCLUSIONS: The early administration of high ratios of FFP and platelets improves survival and decreases overall PRBC need in massively transfused patients. The largest difference in mortality occurs during the first 6 hours after admission, suggesting that the early administration of FFP and platelets is critical.
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OR

MHA We Advocate for Hospitals and the Patients They Serve

MHA Keystone: Surgery

MHA KEYSTONE CENTER FOR PATIENT SAFETY & QUALITY

MHA Keystone: Surgery

Background: Michigan hospitals perform approximately 300,000 surgeries each year. National estimates report complications at 3 percent, resulting in up to 16,000 surgical complications. In addition, literature shows that mortality rates as a result of surgical complications are roughly 3 percent (including infections and other post-surgical complications), costing an estimated \$250 million.

In fall 2007, the MHA Keystone Center, in partnership with the Johns Hopkins University Quality and Safety Research Group, launched MHA Keystone: Surgery. This collaborative now includes more than 100 Michigan hospitals voluntarily participating to improve perioperative patient safety.

MHA Keystone: Surgery aims to eliminate surgical-site infections, prevent mislabeling of specimens, prevent defects in care (including routine adverse events such as wrong-site surgery and retained foreign objects), and improve or reinforce the culture of safety at participating hospitals.

Collaborative interventions focus on methods to improve communication among members of the surgical team, findings are conducted before surgery to confirm the correct patient is in the operating room, to verify the surgical site, to ensure the proper equipment is accessible and to outline possible complications. Interventions are conducted by the surgical team immediately following the procedure to identify defects and discuss the patient's future needs, ensuring a smooth transition to postoperative care.

Lean Six Sigma is used to identify process gaps and eliminate the mislabeling of specimens, retrieved during surgery. Proper labeling and transporting of specimens reduces the risk of misdiagnosis and the potential need for repeat surgery.

Results: Since fall 2007, nearly 443,000 surgical findings and deliveries have been collected by participating hospitals. Findings and deliveries are occurring by roughly 85 percent of the surgeries in participating hospitals. MHA Keystone: Surgery teams have been collecting specimen defect data since fall 2009 and are reviewing and revising the processes used for specimen collection.

A peer review board has been established to provide in-state guidance for the MHA Keystone: Surgery collaborative and to become independent of the Johns Hopkins University Quality and Safety Research Group. The goal of Michigan physicians will incorporate firsthand knowledge of state-specific issues.

Future: As the data submitted to the MHA PSO become appropriately available, it will be used to support the collaborative's efforts in addressing wrong site surgery and retained foreign objects. Participants will include findings and deliveries as part of

OR

Guidelines for the Management of Severe Traumatic Brain Injury

3rd Edition

A Joint Project of the
Brain Trauma Foundation
Improving the Outcome of Brain Trauma Patients Worldwide
and
American Association of Neurological Surgeons (AANS)
Congress of Neurological Surgeons (CNS)
AANS/CNS Joint Section on Neurotrauma and Critical Care

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Mary Ann Liebert, Inc., a publisher

ICU

The New England Journal of Medicine

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VENTILATION WITH LOWER TIDAL VOLUMES AS COMPARED WITH TRADITIONAL TIDAL VOLUMES FOR ACUTE LUNG INJURY AND THE ACUTE RESPIRATORY DISTRESS SYNDROME

THE ACUTE RESPIRATORY DISTRESS SYNDROME NETWORK*

Conclusions In patients with acute lung injury and the acute respiratory distress syndrome, mechanical ventilation with a lower tidal volume than is traditionally used results in decreased mortality and increases the number of days without ventilator use. (N Engl J Med 2000;342:1301-8.)
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ICU

The Journal of Trauma: Injury, Infection, and Critical Care

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Publication Type: [Article]
ISSN: 0022-1382
Accession: 00005373-199911000-00028

[Articles]

The Golden Hour and the Silver Day: Detection and Correction of Occult Hypoperfusion within 24 Hours Improves Outcome from Major Trauma

Blow, Osbert MD, PhD; Magliore, Lissa BS; Claridge, Jeffrey A. MD; Butler, Kathy RN; Young, Jeffrey S. MD

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* First Place, Resident Trauma Paper Competition, Region III, American College of Surgeons Committee on Trauma, December 6, 1997.

Conclusion: Initial lactic acidosis is associated with lower cardiac performance and higher morbidity and mortality. Persistent OH is associated with higher rates of RC, MSOF, and death after severe trauma. Early identification and aggressive resuscitation aimed at correcting continued elevation in serum lactate improves survival and reduces complications in severely injured trauma patients.

ICU

Benjamin Mosher MD



STARROW

TABLE 1

Trauma Resuscitation Protocol

Trauma resuscitation

1. Serum lactate measured
2. In the event of hypotension and/or lactate > 2 mmol/L:
 - a. Deliver an initial minimum of 20 mL/kg of crystalloid
 - b. Apply vasopressors for hypotension not responding to initial fluid resuscitation to maintain mean arterial (MAP) ≥ 65 mm Hg
3. In the event of persistent hypotension despite fluid resuscitation and/or lactate > 4 mmol/L:
 - a. Achieve central venous pressure (CVP) of ≥ 8 mm Hg
 - b. Achieve central venous oxygen saturation of $\geq 70\%$

TABLE 2

Sepsis Bundle

Sepsis bundle (6-h goals)

1. Serum lactate measured
2. Blood cultures obtained prior to antibiotic administration
3. From the time of presentation, broad spectrum antibiotics administered within 3 h for ED admissions and 1 h for non-ED ICU admissions
4. In the event of hypotension and/or lactate > 2 mmol/L:
 - a. Deliver an initial minimum of 20 mL/kg of crystalloid
 - b. Apply vasopressors for hypotension not responding to initial fluid resuscitation to maintain mean arterial (MAP) ≥ 65 mm Hg
5. In the event of persistent hypotension despite fluid resuscitation and/or lactate > 4 mmol/L:
 - a. Achieve central venous pressure (CVP) of ≥ 8 mm Hg
 - b. Achieve central venous oxygen saturation of $\geq 70\%$

Sepsis bundle (24-h goals)

1. Low-dose steroids administered for septic shock in accordance with a standardized ICU policy
2. Drotrecogin α (activated) administered in accordance with standardized ICU policy
3. Glucose control maintained \geq lower limit of normal, but < 180 mg/dL
4. Inspiratory plateau pressures maintained < 30 cm H₂O for mechanically ventilated patients

TABLE 4
Patient Demographics

	2000-2003	2005-2008	P-Value
Mean age (y)	43.9 yrs	45.9 yrs	0.200
Male (%)	66.4%	71.8%	0.010
Mean ISS	29	27	0.250
Blunt trauma (%)	87.1%	89.0%	0.913

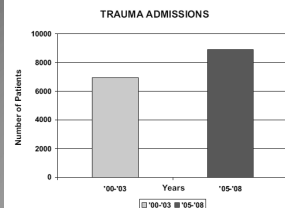


FIG. 1. Total trauma admissions.

VENTILATED ICU PATIENTS

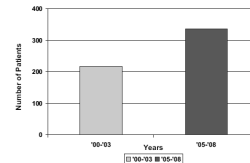


FIG. 2. Admissions to the ICU of mechanically ventilated patients.

MORTALITY RATE

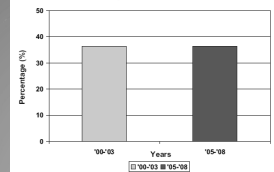


FIG. 3. Mortality rate was 36.4% versus 36.5% ($P = 0.944$).

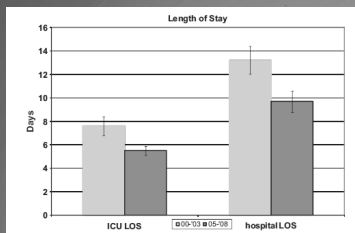
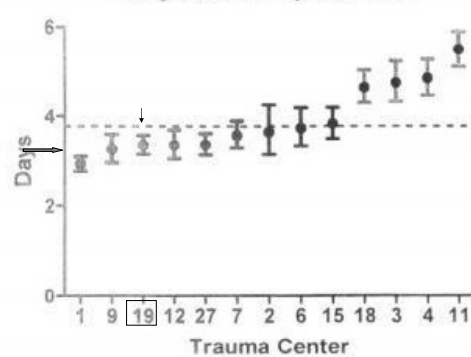
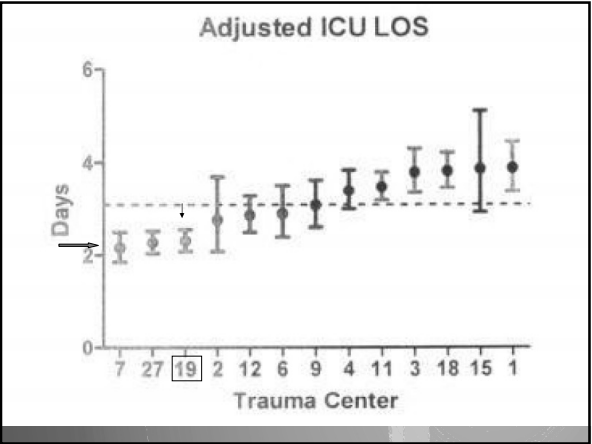


FIG. 4. Duration of ICU and hospital days (error bars \pm SEM).

Adjusted Hospital LOS





PAPER

Prospective Evaluation of the Safety of Enoxaparin Prophylaxis for Venous Thromboembolism in Patients With Intracranial Hemorrhagic Injuries

Scott H. Norwood, MD; Clyde E. McAuley, MD; John D. Berne, MD; Van L. Vallina, MD; D. Brent Kerns, MD; Thomas W. Grahm, MD; Kevin Short, MD; Jerry W. McLarty, PhD

Background: Patients with traumatic intracranial hemorrhagic injuries (IHs) are at high risk for venous thromboembolism (VTE). The safety of early anticoagulation for IH has not been established.

Hypothesis: Enoxaparin can be safely administered to most patients with IH for VTE prophylaxis.

Setting: Level I trauma center.

Design: Prospective, single-cohort, observational study.

Patients and Methods: One hundred fifty (85%) of 177 patients with blunt IH received enoxaparin beginning approximately 24 hours after hospital admission until discharge. Brain computed tomographic (CT) scans were performed at admission, 24 hours after admission, and at variable intervals thereafter based on clinical course. Patients were excluded for coagulopathy, hepatic allergy, expected brain death or discharge within 48 hours, and age younger than 14 years. Complications of enoxaparin prophylaxis were defined as Marshall CT grade progression of IH, expansion of an existing IH, or development of a new hemorrhagic lesion on follow-up CT after beginning enoxaparin use.

Results: Thirty-four patients (23%) had CT progression of IH. Twenty-eight CT scans (19%) worsened before enoxaparin therapy and 6 (4%) worsened after beginning enoxaparin use. No differences between operative patients (2/24, 8%) and nonoperative patients (4/126, 3%) complications were identified ($P = .23$). Study group mortality was 7% (10/150). All 6 patients who developed progression of IH after initiation of enoxaparin therapy survived hospitalization. A deep vein thrombosis was identified in 2 (2%) of 106 patients.

Conclusion: Enoxaparin can be safely used for VTE prophylaxis in trauma patients with IH when started 24 hours after hospital admission or after craniotomy.

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ICU

CHEMICAL VENOUS THROMBOEMBOLIC PROPHYLAXIS IS SAFE AND EFFECTIVE IN PATIENTS WITH TRAUMATIC INTRACRANIAL HEMORRHAGE WHEN STARTED 24 HOURS AFTER ABSENCE OF PROGRESSION OF HEMORRHAGE ON CT

Objectives: Venous thromboembolic disease (VTE) continues to be an important complication in trauma patients, including patients with intracranial hemorrhage. We implemented a protocol starting chemical prophylaxis 24 hours after absence of progression of hemorrhage on CT to increase consistency with the use of chemical VTE prophylaxis in the population.

Methods: Two hundred and five patients with intracranial hemorrhage admitted to a level I trauma center over an 18-month period were reviewed with respect to demographics, type of intracranial injury, need for surgery, injury severity, and progression of injury on brain CT. Patients with a hospital length of stay <3 days were excluded in the analysis of administration of chemical prophylaxis. Time to chemical prophylaxis in relation to absence of progression on brain CT was examined as well as the subsequent rate of progression of hemorrhage and risk of VTE events. The overall rate of VTE was compared to matched historical controls.

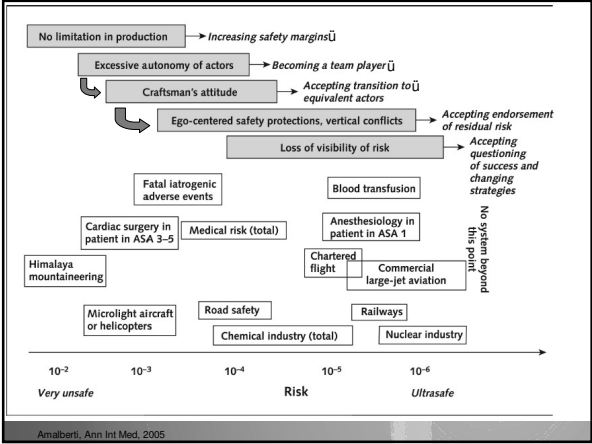
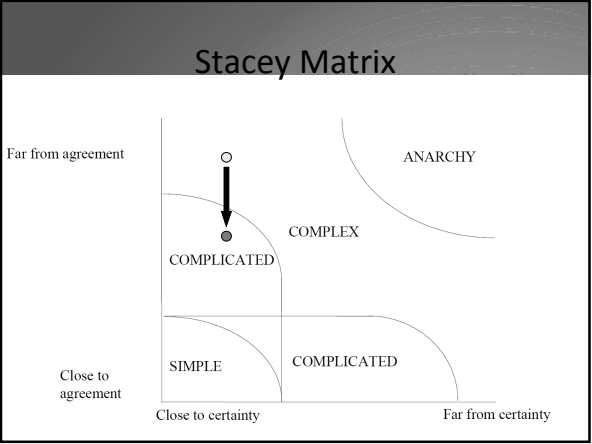
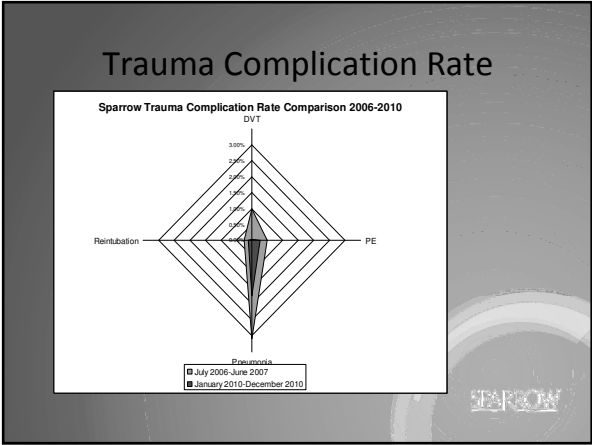
Results: All patients received mechanical prophylaxis in the form of sequential compression devices. Two hundred and sixty-one intracranial hemorrhages were identified with 101 subdural hematomas, eight epidural hematomas, 86 subarachnoid hematomas, and 66 intraparenchymal hemorrhages.

Sixty-eight percent required emergent craniotomy and 4.9% required other emergent surgery. Eighty-six percent three percent of patients had a follow-up CT performed the day after admission and of these 12.2% showed progression.

Of the patients who did not have progression of hemorrhage on follow-up CT, 60.4% received chemical prophylaxis at some point during their stay. Of the patients who received chemical prophylaxis, 35.8% had chemical prophylaxis given within 36 hours of the follow-up CT, 43.2% within 48 hours, 60.0% within 72 hours, and 7.1% within 96 hours.

No patients in this sample had progression of intracranial hemorrhage after initiation of chemical VTE prophylaxis and no patients developed VTE. The overall rate of VTE in all trauma patients decreased from 0.85% to 0.04% over the same time period. No other complications related to chemical VTE prophylaxis were identified.

Conclusions: A protocol based on early use of chemical VTE prophylaxis after absence of progression of traumatic intracranial hemorrhage does not result in increased progression of intracranial hemorrhage and reduced the rate of VTE in our institution.



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side of complexity."*

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