

6.

EXPECTATIONS

(Of hospital for EMS)

RESUSCITATION

EPIPHANY

**“Resuscitation”
is the most
misrepresented
concept of the 20th
Century**

REALLY

Recent Internet Survey

EMS ERRORS

As perceived by Trauma Centers

(December 2015)

EPIPHANY

Stay & Play

vs

Load & Go

Perceived Errors by EMS-1

- **Not many errors – Most of the time --- EXCELLENT**
- **Over estimation of burns**
- **Use of Tourniquets**
- **Attempted Surgical Airway**

Perceived Errors by EMS-2

- Too long at scene
- Needle Thoracentesis
- Too MUCH Crystalloid
- Incomplete communication
- Overuse of spine boards

Things that:

Works

- Dispatch
- Defibrillators
- Rapid transport
- Permissive hypotension
- Helicopter as rescue
- Communications
- Splints & backboards
- Tourniquets
- Data management
- Intubation
- ACS COT Verification Process
- Trauma M&M conference
- Integrated systems

Does not work

- Interosseous infusion
- Helicopter for outcomes
- Aggressive fluids
- Pericardiocentesis
- Red lights & Sirens
- MAST pants
- EOA device
- RSI
- Needle chest decompression
- Pelvic fixators
- Golden hour
- CPR for trauma
- EMS QA
- Trauma center EMS delivery

**This lecture only
contains a few of
the many EMS
controversies**

Con-tro-ver-sy

- prolonged public dispute, strife, argument, debate, wrangle, or contention
- disputation concerning a matter of opinion.

Controversy

- **Allows for an orderly evaluation of different points of view**
- **ALWAYS should be welcomed**

Controversy

- **Every controversy should lead to a research protocol to produce data**
- **Future directions based on data**

RESUSCITATION

Historic Concept

- “Get the patient in shape so that surgery will be tolerated”
- This is an URBAN LEGEND

(Abandon this concept)

Resuscitation (Raise the BP)

Raise the BP - Resuscitate

- **How?**
 - **Drugs, fluids, blood, MAST**
- **Why?**
- **What happens?**
- **Is hypotension bad?**
- **Is hypotension good?**

Specific Controversies

Pre-Hospital Transportation

Stay & Play VS Load & Go

Pre-Hospital Transportation

- **Indications debated**
- **Interventions debated**
- **Ground vs air**
- **Basic vs advanced**
- **Just who should supervise**

Red Lights & Sirens

Ambulance Diversion

Ambulance Diversion

- **Why is it done?**
- **Who profits from diversion?**
- **Does it benefit patients?**
- **What happens to patients diverted from trauma centers?**

Air Ambulance Transport

HEMS decrease transport time

A META-ANALYSIS OF PREHOSPITAL CARE TIMES FOR TRAUMA

Brendan G. Carr, MD, MA, Joel M. Caplan, MA, EMT,
John P. Pryor, MD, Charles C. Branas, Ph.D.

ABSTRACT

Background. Time to definitive care is a major determinant of trauma patient outcomes yet little is empirically known about prehospital times at the national level. We sought to determine national averages for prehospital times based on a systematic review of published literature. **Methods.** We performed a systematic literature search for all articles reporting prehospital times for trauma patients transported by helicopter and ground ambulance over a 30-year period. Forty-nine articles were included in a final meta-analysis. Activation time, response time, on-scene time, and transport time were abstracted from these articles. Prehospital times were also divided into urban, suburban, rural, and air transports. Statistical tests were computed using weighted arithmetic means and standard deviations. **Results.** The data were drawn from 20 states in all four U.S. Census Regions and represent the pre-

INTRODUCTION

The concept of time has been a prominent, but incompletely researched, topic in the trauma literature since the Second World War.¹ The widespread idea of the "golden hour" highlights the immense importance of time to the trauma patient.²⁻⁴ However, at the same time, the "golden hour" concept highlights our very limited understanding of what times, or intervals, are actually being used by local, state, and regional EMS systems in ensuring minimum standards of care for trauma patients.⁵

Rapid responses are believed to be surrogates for the quality of care provided to trauma patients.⁶ Data demonstrating the need for rapid delivery of prehospital care has been done outside of the trauma

- Retrospective Meta-analysis of transport times of patients transported by either helicopter or ground based EMS
- Activation time, response time, scene time and transport time(s) defined
- 155,179 patient records evaluated

HEMS save lives by transporting critically ill patients

The Journal of TRAUMA® Injury, Infection, and Critical Care

Helicopter Scene Transport of Trauma Patients with Nonlife-Threatening Injuries: A Meta-Analysis

Bryan E. Bledsoe, DO, FACEP, A. Keith Wesley, MD, FACEP, Marc Eckstein, MD, FACEP, Thomas M. Dunn, PhD, Michael F. O'Keefe, MS

Background: Helicopters have become a major part of the modern trauma care system and are frequently used to transport patients from the scene of their injury to a trauma center. While early studies reported decreased mortality for trauma patients transported by helicopters when compared with those transported by ground ambulances, more recent research has questioned the benefit of helicopter transport of trauma patients. The purpose of this study was to determine the percentage of patients transported by helicopter who have nonlife-threatening injuries.

Methods: A meta-analysis was performed on peer-review research on helicopter utilization. The inclusion criteria

were all studies that evaluated trauma patients transported by helicopter from the scene of their injury to a trauma center with baseline parameters defined by Injury Severity Score (ISS), Trauma Score (TS), Revised Trauma Score (RTS), and the likelihood of survival as determined via Trauma Score-Injury Severity Score (TRISS) methodology.

Results: There were 22 studies comprising 37,350 patients that met the inclusion criteria. According to the ISS, 60.0% [99% confidence interval (CI): 54.5–64.8] of patients had minor injuries. According to the TS, 61.4% (99% CI: 60.8–62.0) of patients had minor injuries. According to

TRISS methodology, 69.3% (99% CI: 58.5–80.2) of patients had a greater than 90% chance of survival and thus nonlife-threatening injuries. There were 25.8% (99% CI: –1.0–52.6) of patients discharged within 24 hours after arrival at the trauma center.

Conclusions: The majority of trauma patients transported from the scene by helicopter have nonlife-threatening injuries. Efforts to more accurately identify those patients who would benefit most from helicopter transport from the accident scene to the trauma center are needed to reduce helicopter overutilization.

Key Words: Helicopter, Trauma, Prehospital, Overtriage, Overutilization.

J Trauma. 2006;60:1257–1266.

Air Ambulance Issues

- **Indications ?**
- **Used for SEVERE injuries ?**
- **Time benefit ?**
- **Survival benefit ?**
- **Transplant organ recovery ?**
- **Safety ?**

Air Ambulance Issues

- **No use guidelines**
- **>50% patients <24 hr in EC**
- **INCREASES EMS time**
- **DECREASES Survival**
- **Costs > by 20%**
- **Decreased organ recovery**

IS HEMS Safe ??

- 264 deaths since 1972
- 35 deaths in 2008
- Per capita the second deadliest occupation
- Greater than 800 services flying today
 - Voluntary guidelines
 - No mandatory NVG or flight path following



Proposed Safety Rules

- Specific indication for USE
- Increased weather minimums and crew rest requirements
- Use of formal dispatch and flight following procedures
- Terrain and crash avoidance systems
- Flight risk evaluation and training programs



“Procedures”

Needle Chest Decompression

Needle Chest Decompression

- **Recommended in tension pneumothorax**
- **No studies to support this practice**
- **Known complications**
- **Reported deaths**
- **Should be analyzed**

MAST

MAST

Action

- Increased complications
- Increased death
- NOT a good splint
- No extra value in pelvic fractures



CHEST TUBES in the Ambulance?

Cryothyroidomy

Crycothyrodomy

- **Broad community variation**
- **Overuse to Underuse**
- **Unclear as to just when, and why**

Hypothermia for Spinal Cord Injury

Hypothermia-Spinal Cord Injury

- **ONE single case-**
- **Highly publicized**
- **2 liters of a cold crystalloid will not decrease temperature**
- **Hypothermia in trauma patients has other drawbacks**

Cervical Collars



**The Reality
of it all
the so
called
“in line
stabilizatio
n”**



What is known about Collar stabilization.

- Collars will limit head motion
- In healthy INTACT volunteers.



Internal Decapitation

- **Complete, through and through dissociation from front to back**
- **Ligament Rupture**
- **Soft Tissue Rupture**

Internal Decapitation

Survival After Head to Neck Dissociation Injuries

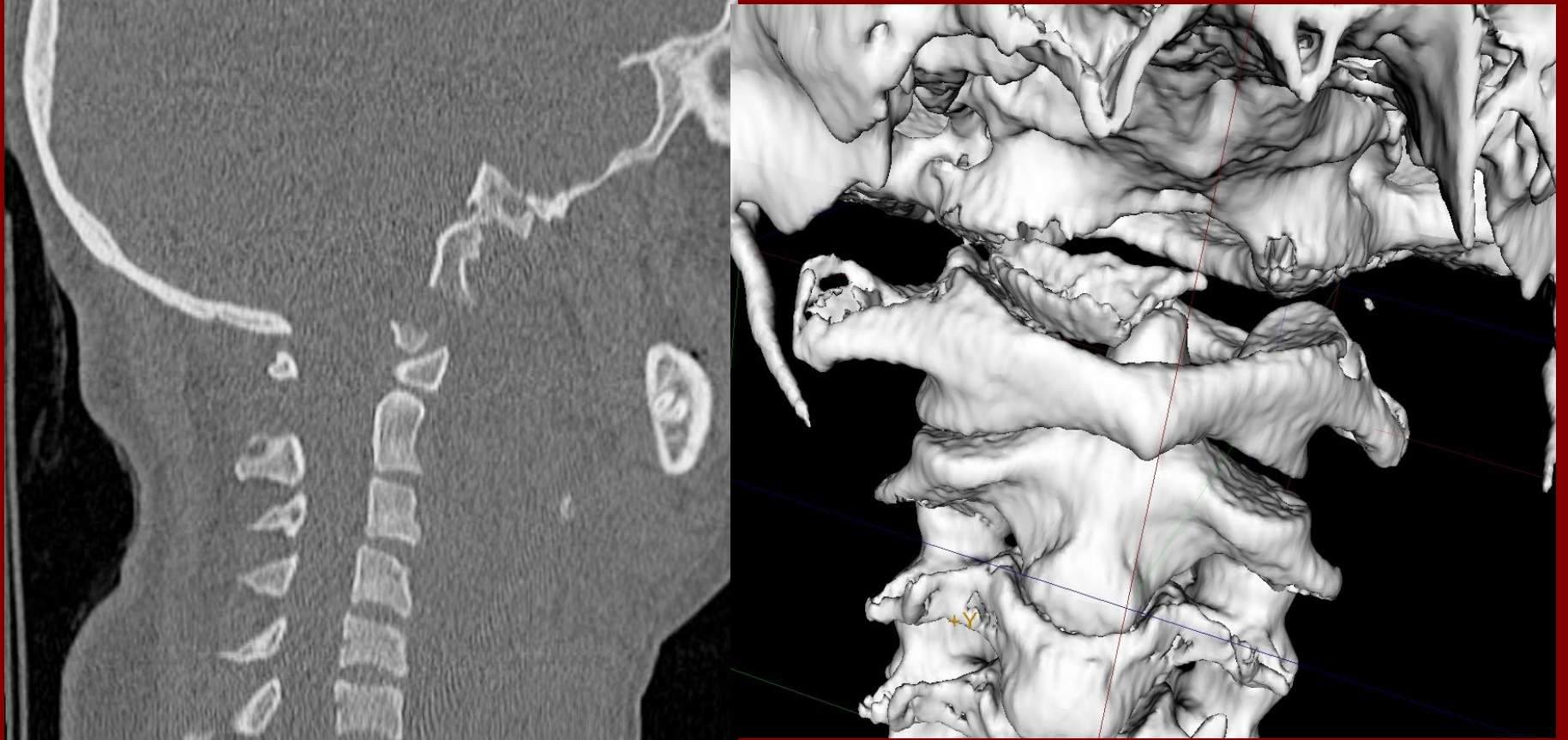
Peleg J. Ben-Galim, MD,* Tarek A. Sibai, MD,† John A. Hipp, PhD,
Michael H. Heggeness, MD, PhD,* and Charles A. Reitman, MD*

SPINE Volume 33, Number 16, pp 1744–1749
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■ **Dissociative injuries are susceptible to traction forces**



Secondary!!! High cervical quadriplegia



17 Y/O, FEMALE, HIGH ENERGY MVA

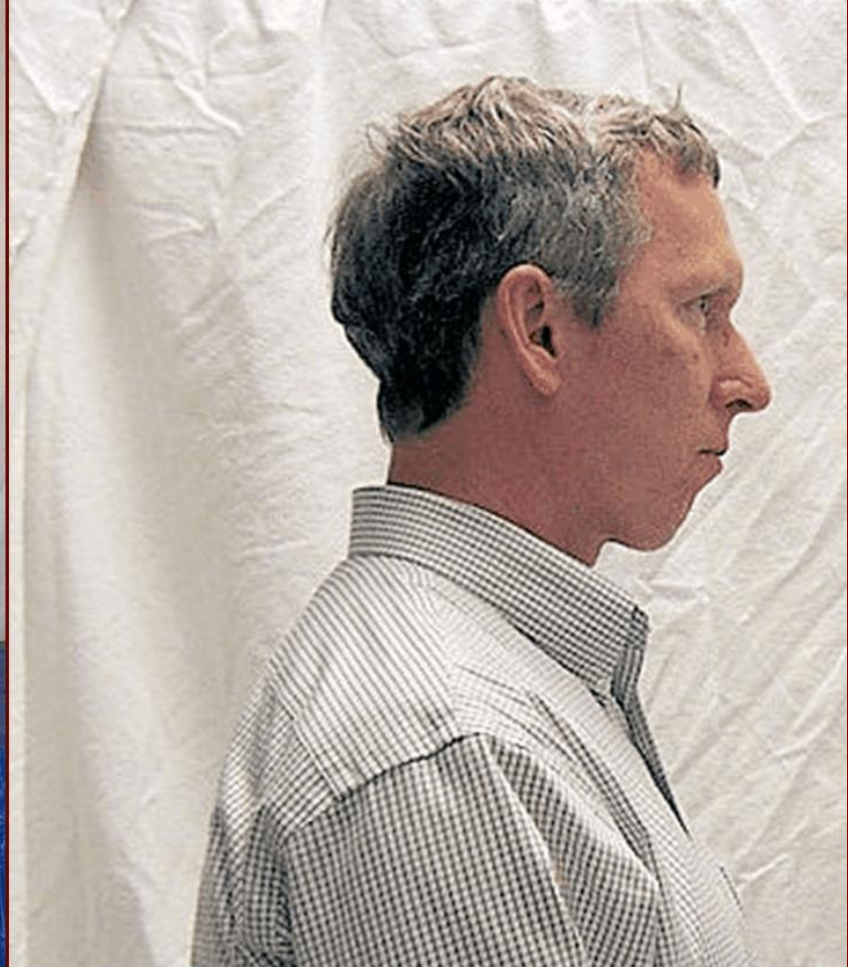
Why do these injuries
happen ?

Acceleration-deceleration Human Trials

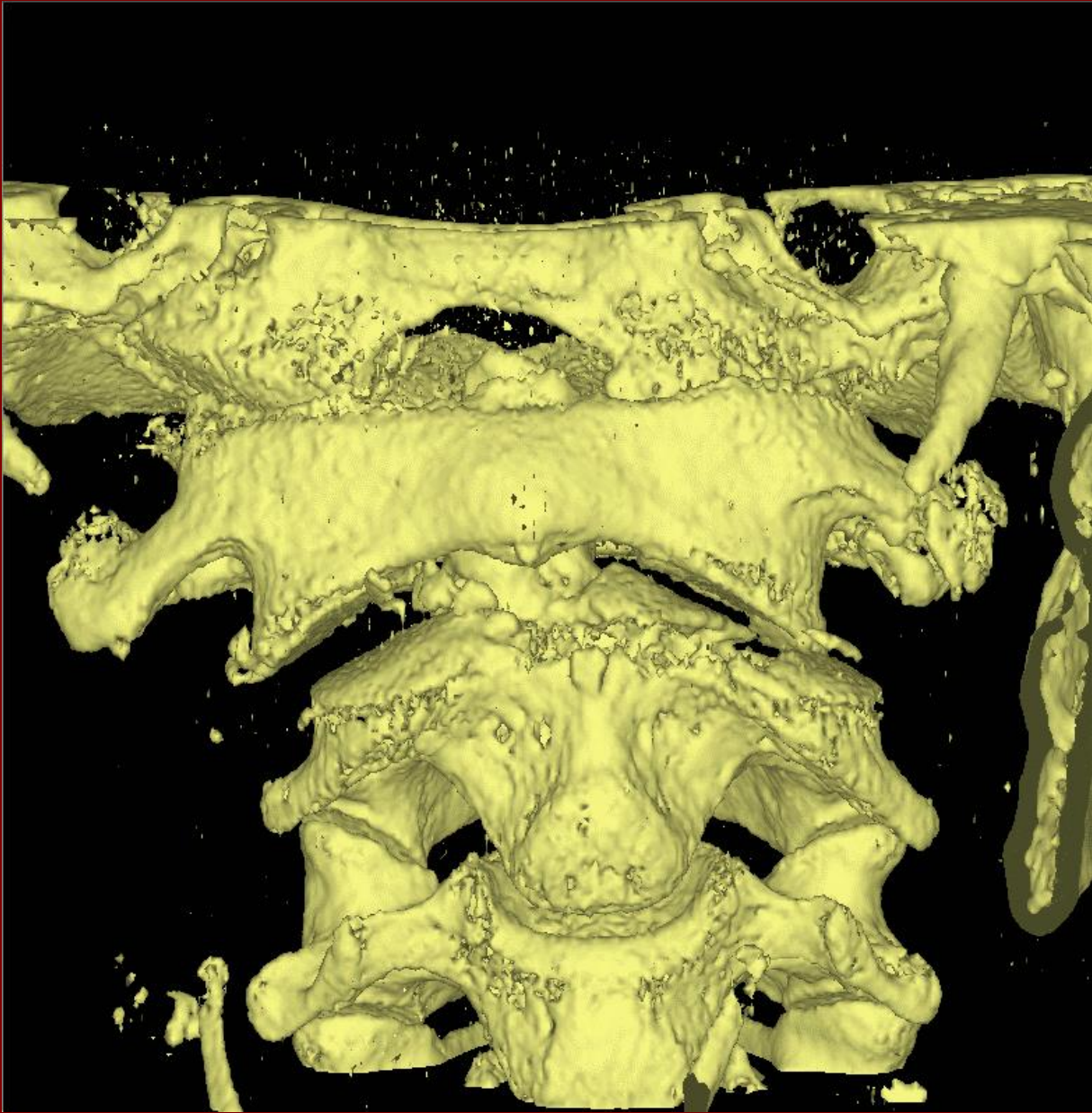


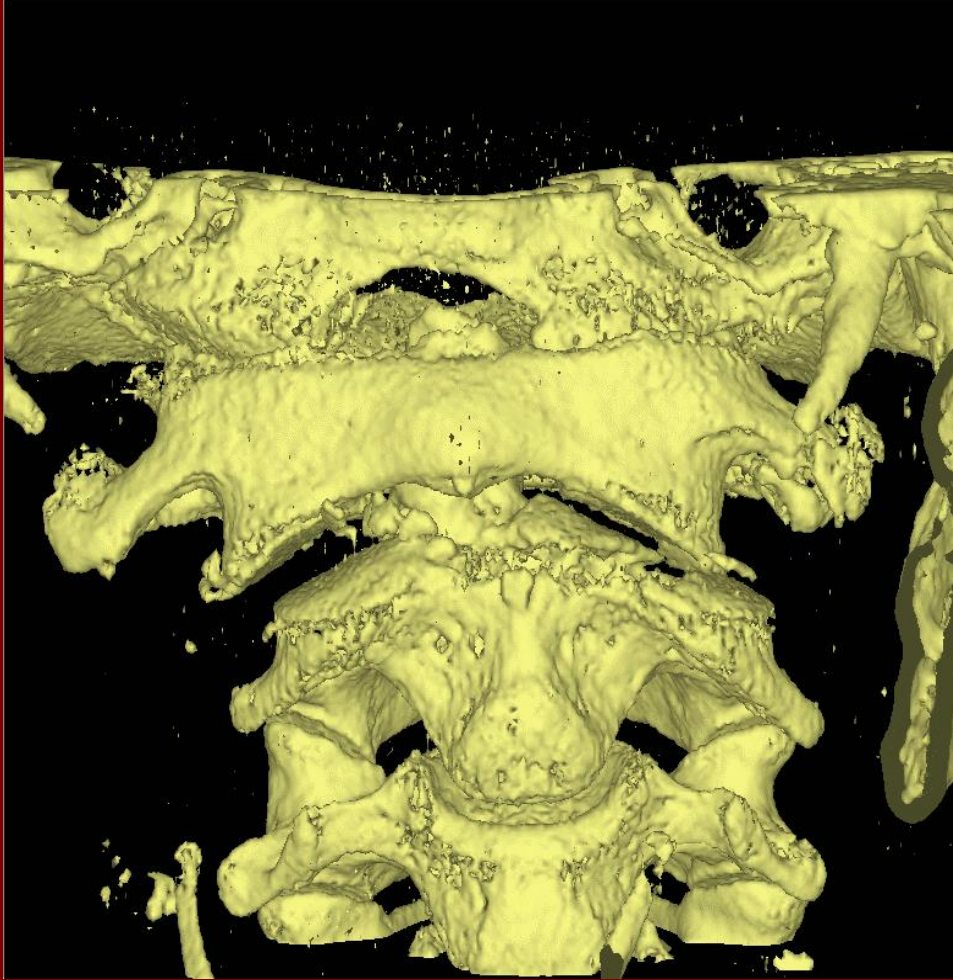
NBDL database

Hypothesis: collar creates distraction ?









INTERNAL DECAPITATION

CPR in trauma

Drawing of BLOOD in the ambulance?

EMS ULTRASOUND?

Trauma Lab Panel

Lab Panel

- **CBC – no help**
- **Metabolic panel – no help**
- **Clotting studies – not needed**
- **ABGs – maybe**
- **T&C – yes**
- **Blood in urine - yes**

New ARMY field Tourniquet



Intravenous Hemostatic Drugs ?

Did not work out

? Topical Hemostatic Agents ?



**“new” topical
hemostatic agents
still not proven**

Crystalloid Fluids (EMS, EC, OR)

Crystalloids

NS, LR, others

- Cause fluid overload
- Cause ARDS
- Cause coagulopathy
- Cause inflammatory response
- Cause immunomodulation
- INCREASE Death & complications

**Recognize the
patient in need of
EMS or EC, or OR
“Intervention”**

...and who does **NOT** need it

**Less than 4% of ALL
trauma patients
actually need or
benefit from
“Resuscitation”
(Whatever that is)**

REALLY

**More than 90% of
ALL
trauma patients need
NO
“Resuscitation”**

Walter Cannon

TRAUMATIC SHOCK

WALTER B. CANNON

TRAUMATIC SHOCK

BY

WALTER B. CANNON, A.M., M.D.

LATELY LIEUTENANT COLONEL, MEDICAL CORPS, UNITED STATES
ARMY; GEORGE HIGGINSON PROFESSOR OF PHYSIOLOGY,
MEDICAL SCHOOL, HARVARD UNIVERSITY; AUTHOR
OF THE MECHANICAL FACTORS OF DIGESTION,
AND BODILY CHANGES IN PAIN, HUNGER,
FEAR AND RAGE

SURGICAL MONOGRAPHS

UNDER THE EDITORIAL SUPERVISION OF

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D. APPLETON AND COMPANY
NEW YORK LONDON

1923

Cannon – World War I

"The injection of a fluid that will increase blood pressure has dangers in itself. Hemorrhage may not have occurred to a marked degree because the blood pressure has been too low to overcome the obstacle offered by a clot."



Less Resuscitation is Best

WWI lessons

- Cannon – JAMA
- “It is wasteful of time, resources and people to give fluid prior to operative control of hemorrhage.”

WW II

Office of the

Surgeon

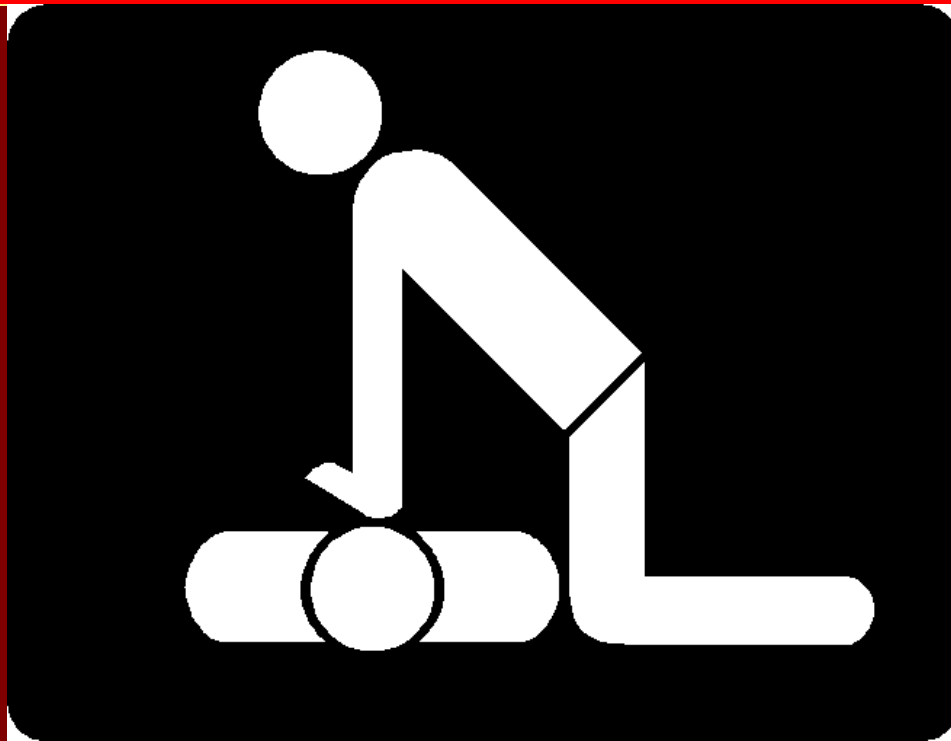
General

Office of the Surgeon General, U. S. Army

WWII lessons

- **2 reports**
- **“BP should not be elevated and fluid not given till operative control of bleeding”**
- **Do not pop the clot and loose precious blood**

1954-1960
CPR
External
Cardiac Compression
(Elan, Safar, Kouwenhoven)



Fluid 3:1 Rule

- **DALLAS**
- **Original studies**
 - **Shires, 1963**
- **Described three isotope model**
- **Showed extracellular repletion with crystalloid essential for survival**

So? Does it work for trauma?

**Not
Really**

The Three to One Rule

- Original studies
 - **Shires, 1963**
- Described three isotope model
- Showed extracellular repletion with crystalloid essential for survival



Fluid 3:1 Rule

- Developed in “controlled hemorrhage” model
- **NEVER** tested in people
- Pre-dated EMS and Trauma Systems
- **Became “doctrine” without any class I, II, or III data**

RESUSCITATION ?

Historic Assessment

A - ALL IVs FULL Flow

B – BP higher than normal

C – Chart Looks good

NOW Call Surgeon

HISTORIC

AMAZING

-Patient's surgery

DELAYED until

“resuscitated” in EMS,

EC, or ICU

This is a NO NO

- **Vietnam experience**
- **Approach to hypotension was 2 large caliber IVs**
- **Give crystalloid as rapidly as possible.**



And NEW Problems happened

Resuscitation Courses

ATLS

ACLS

PALS

(12 others)

Almost identical curriculum

Teach ABCs

Encourage FLUID bolus

Lots of Urban Legends

(Until October 2012)

“Fill the tank”
“Fluid Challenge”

Commonly quoted phrases

Residual, quiet continuing questions

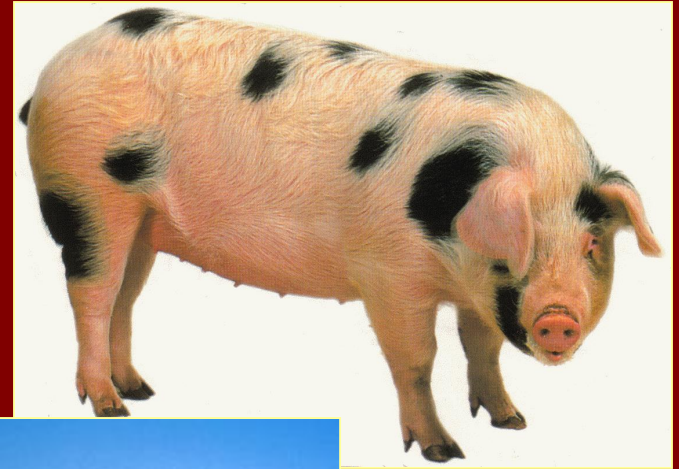
(Did not join bandwagon)

■ 1960s “aggressive fluid administration in uncontrolled hemorrhage resulted in increased mortality”

- Shaftan GW, Chiu CJ, Dennis C, Harris B. Fundamentals of physiologic control of arterial hemorrhage. *Surgery* 1965; 58: 851-856.
- Milles G, Koucky CJ, Zacheis HG. Experimental uncontrolled arterial hemorrhage. *Surgery* 1966; 60: 434-442.

Permissive Hypotension

- 1980s and 1990s-rodent & swine models of hemorrhagic shock
- Aggressive fluid resuscitation in uncontrolled hemorrhage resulted in increased mortality & morbidity





1994 BIG BOMB

Mattox

**Keeping the BP
low saves lives
– Do NOT POP
the CLOT**



The New England
Journal of Medicine

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Volume 331

OCTOBER 27, 1994

Number 17

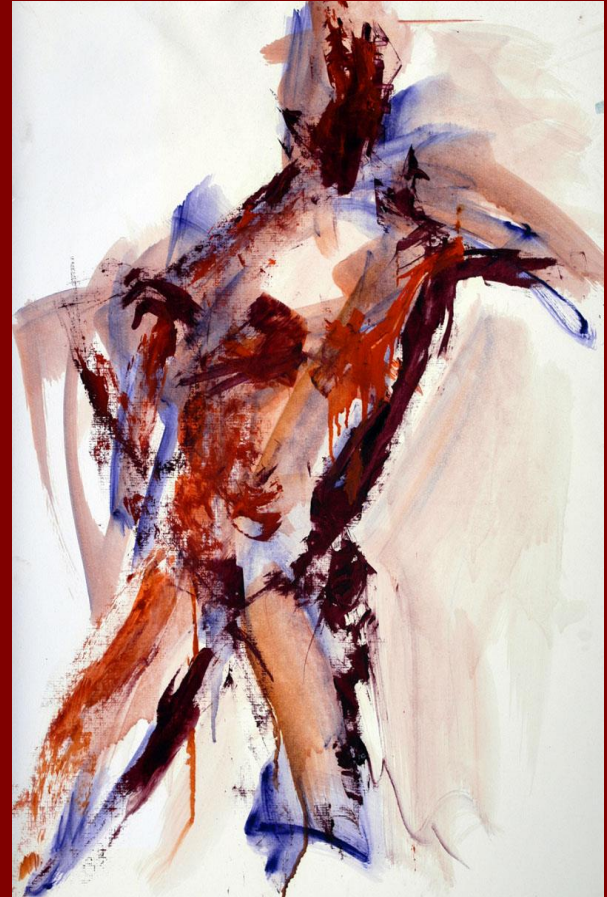
**IMMEDIATE VERSUS DELAYED FLUID RESUSCITATION FOR HYPOTENSIVE PATIENTS
WITH PENETRATING TORSO INJURIES**

WILLIAM H. BICKELL, M.D., MATTHEW J. WALL, JR., M.D., PAUL E. PEPE, M.D.,
R. RUSSELL MARTIN, M.D., VICTORIA F. GINGER, M.S.N., MARY K. ALLEN, B.A.,
AND KENNETH L. MATTOX, M.D.

Permissive Hypotension

- **1994 – 1st clinical evaluation of fluid restriction in uncontrolled hemorrhage**

Mattox: Immediate versus delayed fluid resuscitation for hypotensive patients with penetrating torso injuries. *N Eng J Med.* 1994;331:1105-9



Permissive Hypotension

(Bickel et al)

- 598 patients with penetrating torso injury & systolic BP \leq 90 mmHg in prehospital setting
- Patients randomized to receive high-volume fluids, or fluids delayed until patient in OR



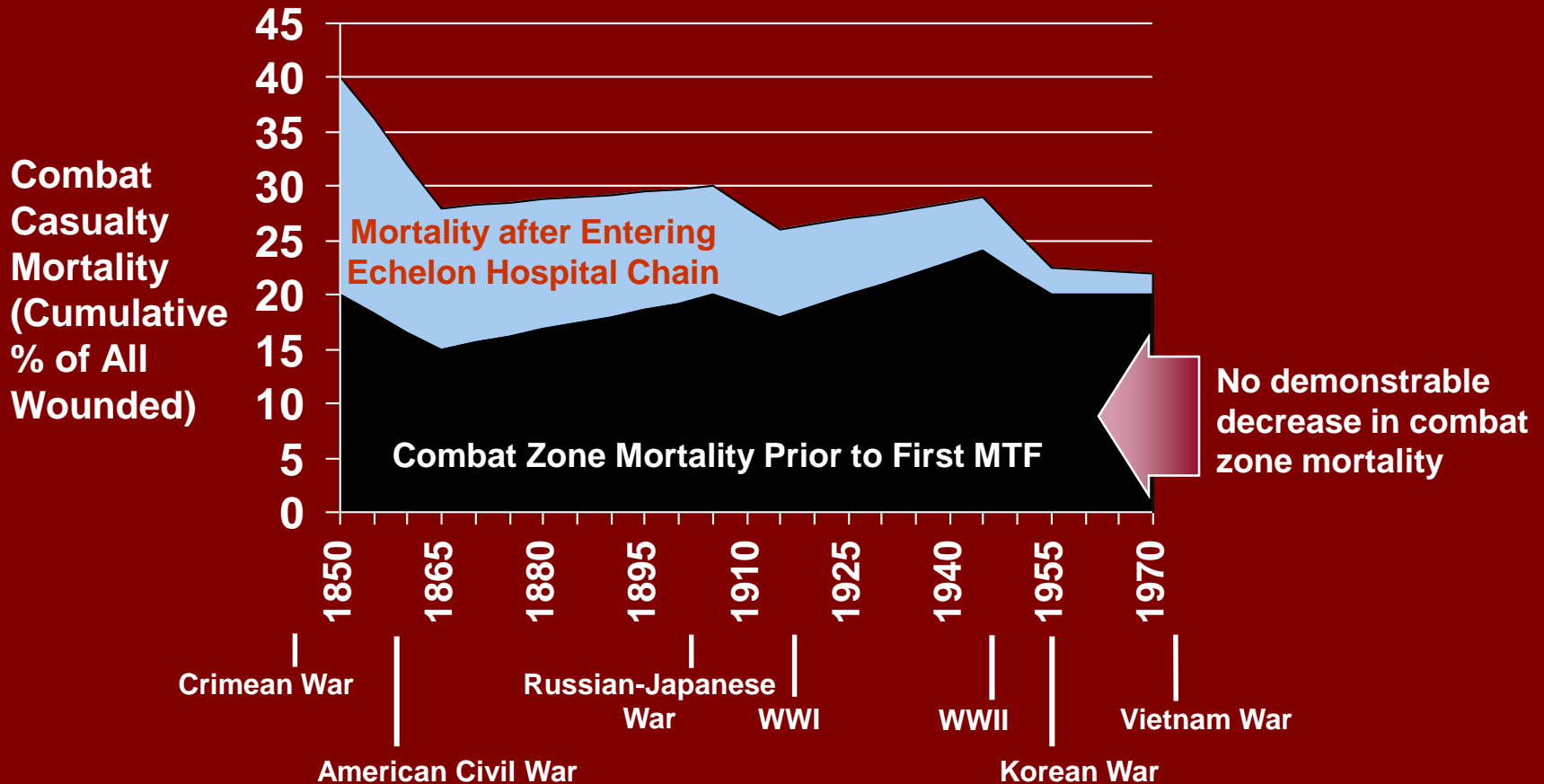
Permissive Hypotension

- **Results:**
 - **Group Divisions**
 - Delayed: n=289
 - Standard fluids: n=309
 - **Survival:**
 - Delayed: 70%
 - Standard fluids: 62%
 - **Complications:**
 - Delayed: 23%
 - Standard fluids: 30%



Statistical
Significance
Other studies
supportive

In-Theater Combat Mortality*



*Slide from Dr. Jane Alexander, DARPA

In-Theater Combat Mortality*

Killed in Action (KIA) in Iraq

12.2%

**(Averaged 20% for all wars since
Crimean War)**

WHAT WAS DIFFERENT IN IRAQ?

*Source – USUHS Symposium March 26, 2004

Redefine RESUSCITATION

Abandon use of Sphygmomanometer



Mental Status

Presence of a pulse

Hypotensive Resuscitation
What BP PEAK is
BEST?

What BP Target is BEST?

<80/-

Higher POPS the CLOT

Function of the EC in the “hypotensive” trauma patient

Bypass the EC for the OR



Wave to the patient as they go from ambulance bay to the OR or ICU

**NOVEL NEW
CONCEPT
RAPID OPERATION**

**EARLY (immediate)
aggressive operative
(or critical care)
intervention**

NOVEL NEW FLUID POLICY

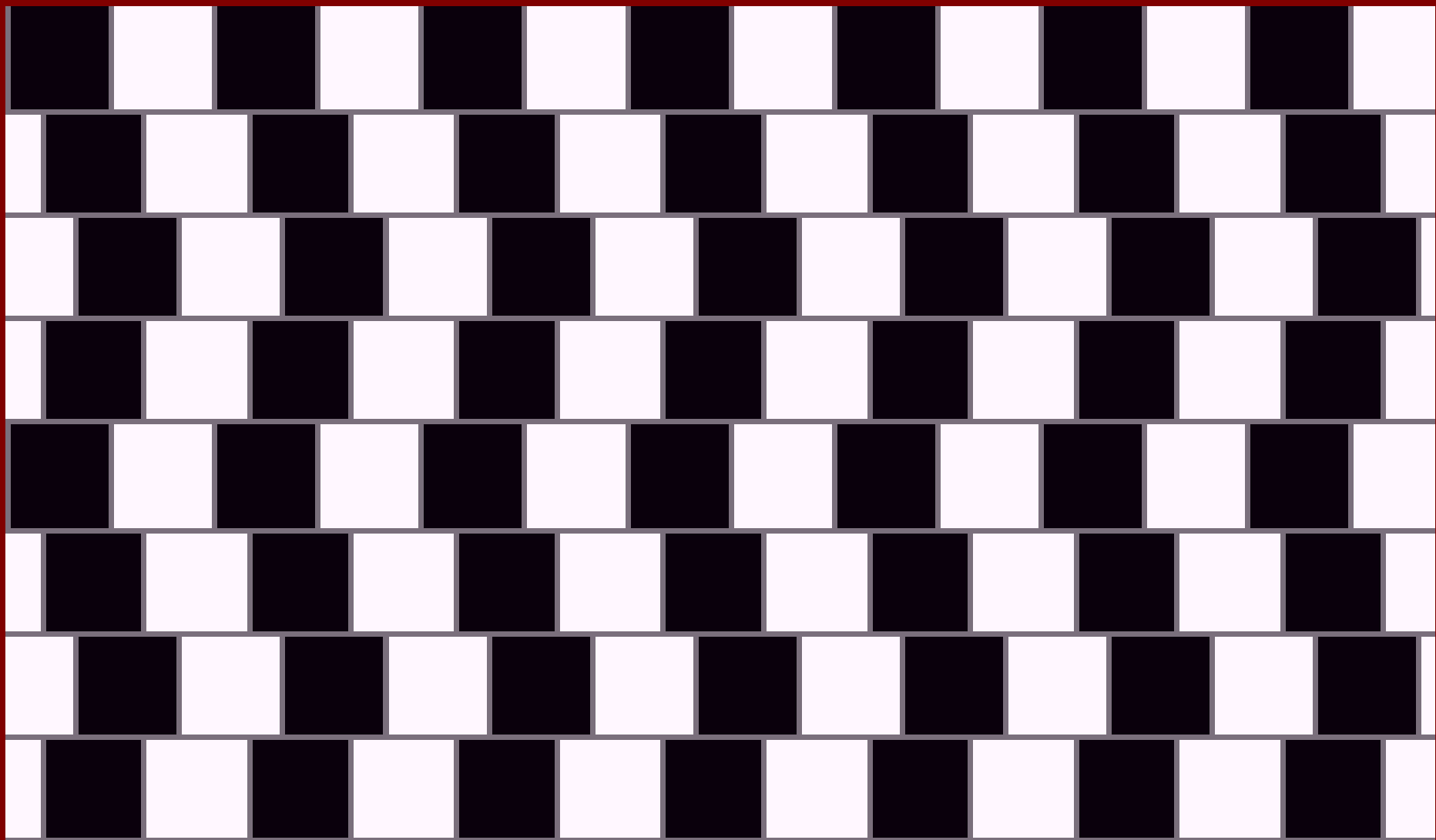
Permissive Hypotension

- Elevation of BP to pre-injury levels (absent definitive hemostasis) is associated with:
 - Progressive and repeated re-bleeding
 - Hypoxemia from excessive hemodilution



Major NEW Lesson

- **Replace blood loss with (FRESH) blood**
- **Match blood with FFP (1:1)**
- **For each unit of blood – give 1 unit of platelets (1:1:1)**
- **RESTRICT crystalloid**



Hurdsfield, ND

January 15, 1992

**Both arms severed in farm
accident**

Teen's savvy saves arms torn off in farm accident

HURDSFIELD, N.D. (AP) — A teenager's arms were torn off in a farm accident, but he used a pencil clenched in his teeth to telephone for help and surgeons were able to reattach the limbs, relatives said.

John Thompson underwent surgery at a Minneapolis hospital Saturday. His condition was upgraded from critical to serious but stable, a nursing supervisor said Tuesday.

"His life is still in danger. The most the doctors are hoping for is that he'll get the use of his arms," said his sister, Kim Blotter. "They don't think his hands will be of use."

Thompson, 18, a senior at Bowdon High School, was home alone grind-



Thompson

ing feed for pigs Saturday when he got caught in a tractor's power take-off unit. It ripped his right arm off at the shoulder and his left arm off near the elbow. Thompson staggered about 400 yards to his home.

"John tried to get in one door and couldn't," said Lynn Thompson, an uncle. "So he went into the garage and opened the door to the house with his mouth." He kicked in the door to the den, where he picked up a pencil with his teeth and used it to telephone a nearby cousin.

Then he waited for help in the bathroom so he wouldn't bleed on the carpets, the family said.

He remained conscious and probably didn't bleed to death because of shock and the irregular shape of his wounds, Blotter said.

"The ambulance driver found the arms and packed them up," Lynn Thompson said.

The boy's parents, Larry and Karen Thompson, have talked to John, who is kept sedated.

**“He did not bleed
to death...because
he was in shock.”**

**--Sister of boy with two
severed arms**

Future Controversies

NEW FIELD Drugs

- **Create HYPOTENSION**
- **Freeze Dried Plasma**
- **TXA**
- **Clot busters for STEMI & Stroke**

Endovascular Balloons & Stents

- **Adaptation of new wave of vascular control & therapy**
- **Readily adaptable to field and EC use, under surgical supervision**
- **Balloons & Clamps**

Pre-Hospital Damage Control

- **Permissive hypotension**
- **Special new foams & compressors**
- **Endovascular balloon control**
- **Do no new harm**
 - **Harm was done by many early EMS interventions**

Trauma Urban Legends

Pelvic Fixators

- **No real evidence to decrease bleeding**
- **No survival advantage**
- **Have complications of their own**
- **No advantage over sheet wrap**

Trauma Urban Legends

Arterial embolization of Pelvic Fx

- 85% bleeding is venous
- Arteriogram usually shows only minor bleeding
- No real EBM to support this tactic
- Often over rated

Trauma Urban Legends

Helicopter as 1st Responder

- Logic for WAR zone
- NO data to support civilian use
- < 40 miles/minutes INCREASE death rate
- 10X the cost of ground ambulance
- Advertising gimmick
- Significant overuse

Trauma Urban Legends

Interosseous Fluid Infusion

- **Cruel form of iatrogenic trauma**
- **No data to support tactic in children or adults**
- **Based on logic the fluid increases BP and elevation of BP increases survival**

Trauma Urban Legends

Stabilization at Scene

- **Stay & play vs load and go**
- **Time should be < 5 minutes**
- **Leads to over treatment**
- **For critical patients, need an OR, not playing with toys in field or EC**
- **Fallacy of European system**

Trauma Urban Legends

EM supervision of Trauma EMS

- EMS QA of trauma is a mandatory function of the trauma system
- State, Trauma System, & Trauma center responsibility
- EMS directors often distant from EMS program
- On line & off line supervision

Trauma Urban Legends

Field Rapid Sequence Intubation

- **Requires sedation & paralysis**
- **Frequently overused as an ego trip**
- **Ties hands of EC surgeons**
- **Rarely QAed by trauma service**
- **Should be eliminated**

Trauma Urban Legends

Needle Thoracic Decompression

- **Diagnosis of tension pneumothorax is extremely rare**
- **Needle thoracostomy can cause significant iatrogenic injury**
 - **Systemic air embolism**
 - **Pulmonary hematoma**
 - **Vascular injury**

Trauma Urban Legends

Golden Hour

- **Term coined by R A. Cowley**
- **Marketing ploy**
- **Multiple population based studies, not ONE has found the golden hour**
- **Time as independent variable probably does NOT influence outcome**

Trauma Urban Legends

CPR for Trauma

- **Not intubated-NO survivors after 4 minutes**
- **Intubated-NO survivors after 10 minutes**
- **When God puts his hands on, take yours off-recognize death**
- **CPR a societal HOAX**

Trauma Urban Legends

Esophageal Obturator Airway

- **Interesting concept**
- **Huge sales market (6 years)**
- **Esophageal tears common**
- **100% aspiration with removal**
- **NO demonstrated survival advantage**

Trauma Urban Legends

Pericardiocentesis

- In ATLS & ACLS courses
- Creates MORE iatrogenic SW of the heart than saves
- Blood often clotted
- **SHOULD BE ABANDONED**

Trauma Urban Legends

Surgeons in Field Response

- **Misuse of surgery training**
- **NO data to support this logic**
- **Probably NO MDs in field should be the rule**
- **Too much time on hands if surgeons go romping in the field**

Trauma Urban Legends

Rapid Infusers

- **4 types sold**
- **Logic is to increase BP**
- **Contributes to cyclic hyper resuscitation and fluid overload**
- **Required by ACS VRS (bad)**
- **Makes a nice coat rack**

Trauma Urban Legends

CT of Chest for ACUTE Trauma

- **Does NOT provide any useful information which is NOT present on initial chest X-ray**
- **Leads to other tests**
- **Blind knee jerk ordering**
- **Over read by radiologist**
- **Helical CT even more confusing**

Rule

**Do not order any test
unless the results of
that test are going to
influence decision
making**

Trauma Urban Legends

IVa for Post Trauma Bleeding

- **No real prospective randomized studies**
- **Reported results very mixed with barely marginal differences**
- **Extremely expensive**
- **Science needs to be worked out**

Trauma Urban Legends

Clamping of Chest Tubes

- **Demonstrates TOTAL lack of knowledge regarding pleural anatomy and physiology**
- **Only indication-anticipating autotransfusion**
- **Every chest tube clamping = mandatory QA and required explanation**

Trauma Urban Legends

Splenic Preservation in Adults

- **OPSS extremely over rated**
- **Death from late hemorrhage from spleen still exists**
- **Splenectomy in adults extremely well tolerated**
- **Vaccines also over rated in non immunologic compromised patients**

Trauma Urban Legends

Subxyphoid Pericardial Window

- **Why use an abdominal incision for a chest injury ???**
- **DUMB concept**
- **NO prospective randomized studies to support use**
- **Technical ego trip**
- **Creates NEW problems**

Trauma Urban Legends

Cardiac Contusion

- **Excessively overused term**
- **No real definition**
- **Term should be replaced with “blunt cardiac injury, with....”**
- **Range of cardiac injury not understood or described**

Trauma Urban Legends

Steroids in Spinal Cord Injury

- **ALL studies showed NO functional benefit**
- **Many sponsored by drug firms**
- **Complications of steroids common**
- **USE should be immediately STOPPED**

NOVEL NEW EVALUATION

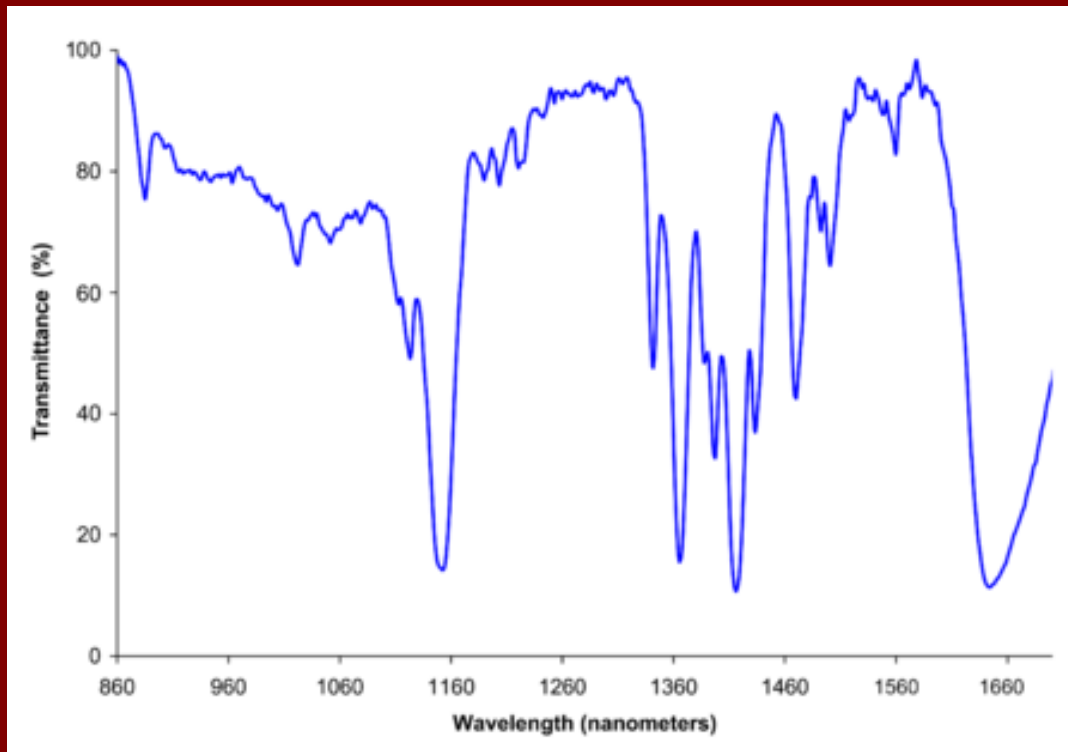
Abandon use of Sphygmomanometer



Mental Status

Presence of a pulse

Near Infrared Spectroscopy



**...but the question
remains
?**

And.....

FINALLY

Real life data

BTGH 2008-2014

Prospective Randomized Research

- **Entry – Trauma - BP <90/- in EC**
- **Exclude: Head injury, >40 yrs**
- **In the OPERATING ROOM**
 - **Keep BP mean at 50 mm/Hg**
 - **Keep BP mean at 65 mm/Hg**

Machiavellia “The Prince”

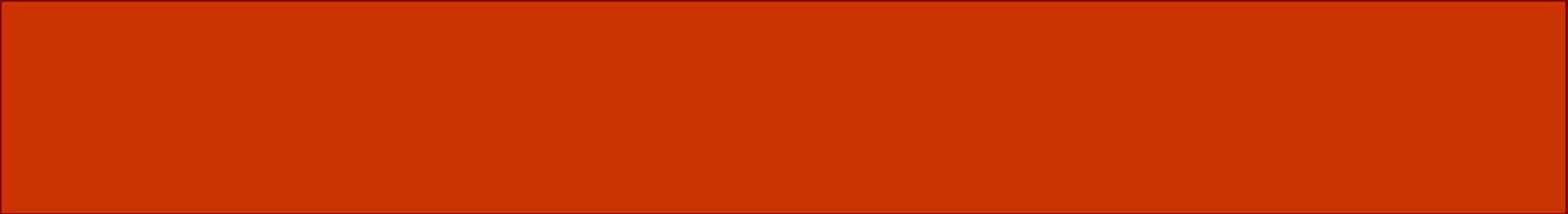
“There is nothing more difficult to take in hand, nor perilous to conduct, nor more uncertain in its success than to take the lead in introduction in a new order of things....”

Machiavellia “The Prince”

...for the innovator has for enemies, all those who have done well under the old and lukewarm defenders those who might do well under the new.”

Disclaimer

- **97.3% of the material presented in this talk is gospel true**
- **2.7% was stated merely for effect**



**You, the listener, do
not know which is
truth, and which is
hyperbole**