

Initial Assessment and Management in Multi-trauma Patients

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Objectives

- Compare and contrast
 - Early Total Care (**ETC**)
 - Damage Control Orthopedics (**DCO**)
 - Early Appropriate Care (**EAC**)
- Resuscitation is Key!



Is the patient clear (Stablized for planned procedure)?!

When should I operate?

What procedure(s) should I perform (temporize or definitive)?

Initial Survey-

- **ABC**
 - **Airway/Breathing/Circulation**
- **Open fractures**
 - **Immediate Abx / Wash / Reduce**
- **Hemorrhagic Shock- Stable vitals ≠ Stable patient**

Class	% Blood loss	HR	BP	PH	MS	Treatment
I	<15%	Normal	Normal	Normal	Anxious	Fluid
II	15%-30%	>100	Normal	Normal	Confused	Fluid
III	30%-40%	>120	Decreased	Decreased	Lethargic	Fluid&Blood
IV	>40%	.>140	Decreased	Decreased	Lethargic/Coma	Fluid&Blood

Fluid Management

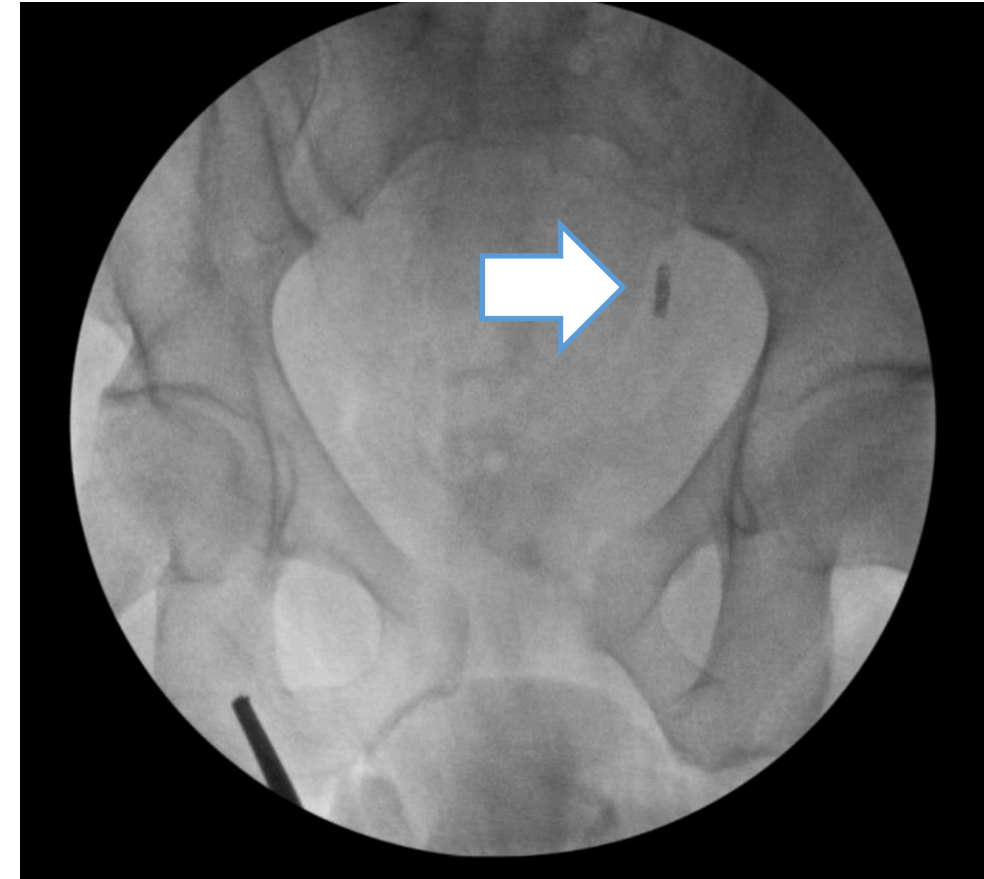
- **Goal is to optimize circulatory system to ensure sufficient oxygen delivery.**
- **Fluid therapy- first line**
 - **Crystalloids – Isotonic solution**
 - **Osmolarity is close to plasma and is considered safe/universal**
- **Blood-**
 - **O negative blood (universal donor)**
Lowest risk of blood transfusion reaction
 - **Transfuse in 1:1:1 ratio (RBC:Platelets:Plasma)**
Aims to correct both early coagulopathy and volume status

Resuscitation

- **Indication of adequate resuscitation**
 - **Serum Lactate/Base Deficit indication of end organ low perfusion which leads to acidosis**
 - **Serum Lactate Level- Normal <2.5 mmol/L**
 - **Base Deficit - Normal -2 to +2**
 - **Higher serum lactate/ Base Deficit indicated acidosis – low oxygenation of end organs**
 - **Serum Lactate more sensitive than base deficit**

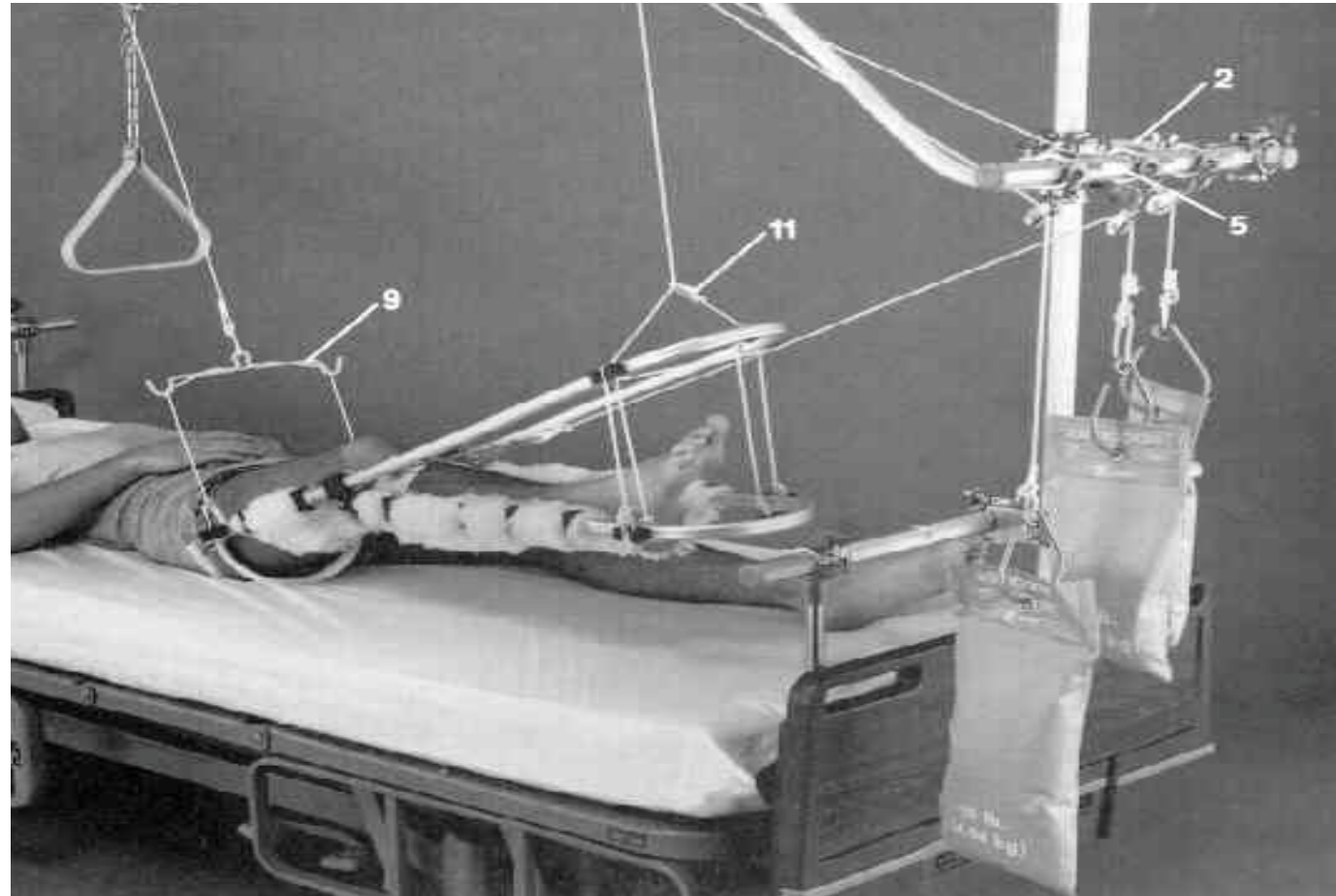
Interventional Radiology

- Increasingly used as adjuncts to hemorrhage control – patient not responding to fluids/blood
- Used frequently in pelvic and acetabular fractures with increased pelvic volume
 - Arterial Blush on CT scan
 - Increased Pelvic volume not responding to pelvic binder or Exfix.
- Can be diagnostic/therapeutic in patients in shock with no obvious cause of hemorrhage.



1970s- Delayed Treatment

- “Too sick for fracture surgery”
- Patients remained in traction until improved enough for surgery...
- Pulmonary complications, VTE, fat emboli



Blunt Multiple Trauma (ISS 36), Femur Traction, and the Pulmonary Failure-Septic State

ROGER SEIBEL, M.D., JOHN LADUCA, M.D., JAMES M. HASSETT, M.D., GEORGE BABIKIAN, M.D.,
BARBARA MILLS, M.A., DONNA O. BORDER, M.A., JOHN R. BORDER, M.D.

Buffalo NY, 1985

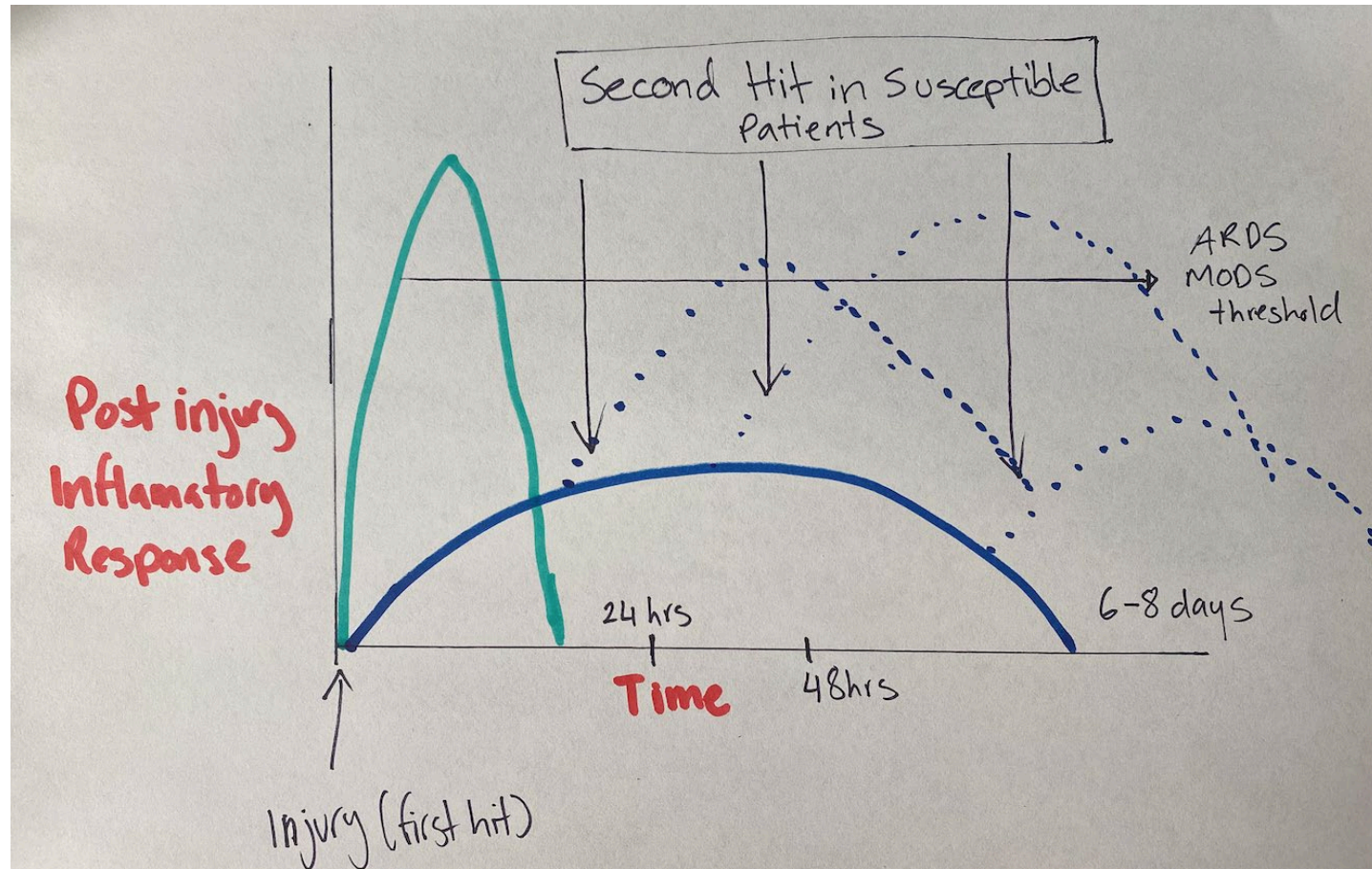
- 56 Poly trauma patients with femur or acetabular fracture and ISS>22
 - Group I: femur or acetabulum fixed night of admission with immediate vent support
 - Group II: traction with vent support
 - fracture fixation delayed to **avg of 10 days**

Results- Waiting too long is BAD

- **Group 2 had 2x “Pulmonary failure septic state” (A-a gradient >100, + fever/WBC)**
 - **10x number of positive blood cultures**
 - **3.5x fracture complications**
 - **2x narcotic use**
 - **Vent and ICU days 2x**

So when is the optimal time for stabilization?

- Systemic Inflammatory Response Syndrome (SIRS)
- 2- Hit Model



2 Hit Model

Posttraumatic Inflammatory Response, Secondary Operations, and Late Multiple Organ Failure

Waydhas, Christian MD; Nast-Kolb, Dieter MD; Trupka, Arnold MD; Zettl, Ralph MD; Kick, Margit; Wiesholler, Johannes; Schweiberer, Leonhard MD; Jochum, Marianne PhD

We conclude that secondary operations may act as a second insult and may precipitate late multiple organ dysfunction syndrome if they are performed in patients with multiple trauma while they still have an increased level of posttraumatic inflammation.

Early versus Delayed Stabilization of Femoral Fractures

A PROSPECTIVE RANDOMIZED STUDY*†

BY LAWRENCE B. BONE, M.D.‡, KENNETH D. JOHNSON, M.D.§, JOHN WEIGELT, M.D.¶,
AND ROBERT SCHEINBERG, M.D.¶, DALLAS, TEXAS

*From the Division of Orthopaedic Surgery, University of Texas Southwestern Medical Center at Dallas
and Parkland Memorial Hospital, Dallas*

- 1989
- In the Poly trauma patient
 - stabilization within the initial twenty-four hours decreases pulmonary morbidity (ARDS, fat emboli, PNA)
 - >48hrs associated with + 5 ICU and 10 HD days
 - 50% less hospital costs when fixed early
 - stabilization decreases embolization of fat marrow and decreases pain and administration of narcotics (respiratory depressants)

External Fixation as a Bridge to Intramedullary Nailing for Patients with Multiple Injuries and with Femur Fractures: Damage Control Orthopedics

Thomas M. Scalea, MD, Sharon A. Boswell, RN, CEN, Jane D. Scott, ScD, MSN, Kimberly A. Mitchell, MS, Mary E. Kramer, RN, and Andrew N. Pollak, MD

Retrospective study immediate IMN vs Exfix then conversion to IMN

Patients that had higher ISS and were sicker underwent external fixation

Compared to immediate IMN; staged EF in sicker patients had the same outcomes.

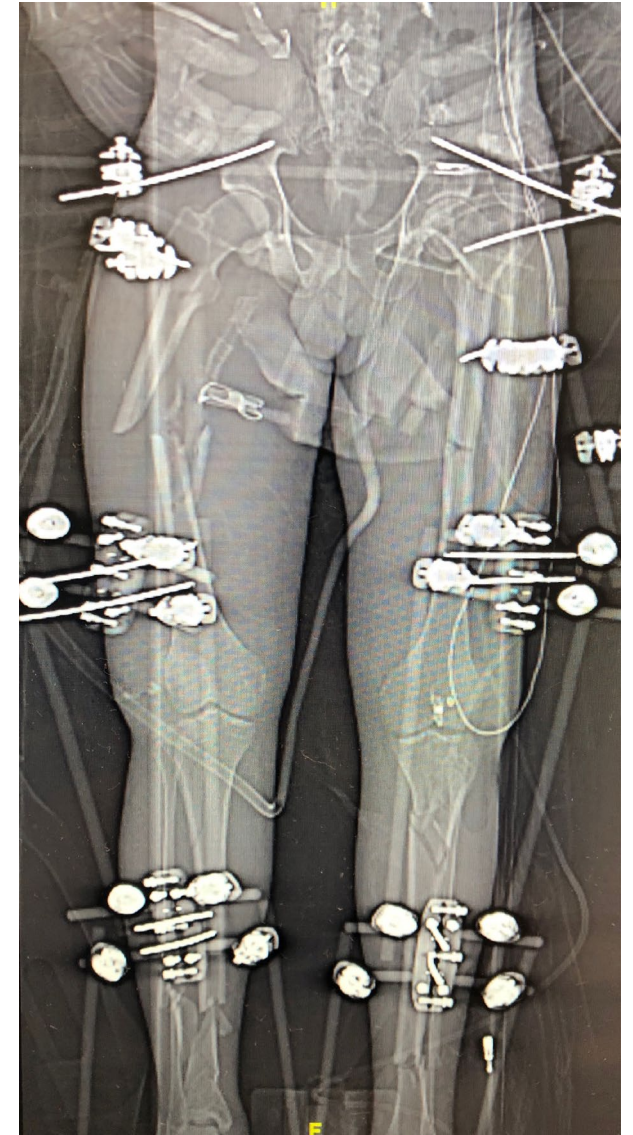
External fixation is a viable option with low complications in patients with multiple injuries

***Ex fix are a temporary measure – Increased infection rates documented when conversion is delayed over 10-14 days.



Damage Control Orthopaedics

- First coined in 2000 by Scalea et al.
Shock Trauma Experience
- Rapid temporary stabilization/ resuscitation prior to definitive treatment- Long bones/Pelvis
- Goal is to restore length/alignment and provide relative stability
- Don't confuse speed with carelessness- adhere to principals. Must restore Length & Alignment



Damage Control Orthopaedics

- Limited early surgical intervention for stabilization of musculoskeletal injuries in the unstable polytrauma patient.
- *Goals of DCO*
 - limit ongoing hemorrhage and soft-tissue injury through efficient fracture stabilization
 - **minimize additional physiologic insult- LIMIT THE 2nd hit**
 - care is taken to avoid development of the lethal triad (hypothermia, coagulopathy, and acidosis)
 - limit secondary injury to vital organ systems, such as the brain and lungs.

Alterations in the Systemic Inflammatory Response after Early Total Care and Damage Control Procedures for Femoral Shaft Fracture in Severely Injured Patients

Paul John Harwood, MB, ChB, Peter V. Giannoudis, MD, Martijn van Griensven, MD, Christian Krettek, MD, and Hans-Christoph Pape, MD

Conclusion: It would appear that despite more severe injuries in the DCO group, patients had a smaller, shorter postoperative SIRS and did not suffer significantly more pronounced organ failure than the IMN group. DCO patients undergoing conversion while their SIRS score was raised suffered the most pronounced subsequent inflammatory response and organ failure. According to these data, DCO treatment was associated with a lesser systemic inflammatory response than early total care for femur fractures. The inflammatory status of the patient may be a useful adjunct in clinical decision making regarding the timing of conversion to an intramedullary device.

Changes in the Management of Femoral Shaft Fractures in Polytrauma Patients: From Early Total Care to Damage Control Orthopedic Surgery

Hans-Christoph Pape, MD, Frank Hildebrand, MD, Stephanie Pertschy, MD, Boris Zelle, MD, Rayeed Garapati, MD, Kai Grimme, MD, and Christian Krettek, MD

2002

- Retrospective data from 1975-2000. 4,628 patients
 - Early Total Care (1981-89)
 - Damage Control Orthopedics (1993-2000)

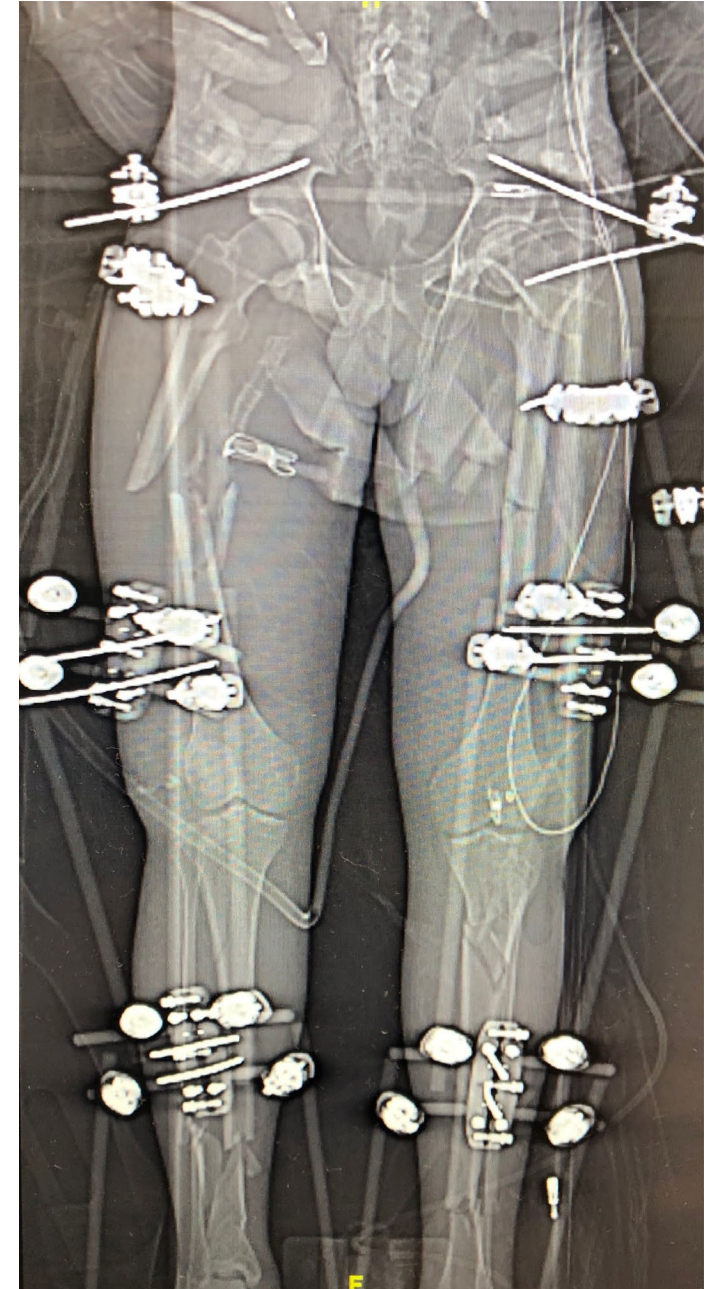
The relative percentage of patients who developed ARDS decreased from 54.6% (ETC) to 26.4% (DCO)

DCO improved patient outcomes but can't forget that other factors changed during the 90s and 2000s that can attribute to better results

- **Prehospital treatment**
- **Multi disciplinary approach**
- **Better understanding of poly trauma and training**
- **Implant design**

Downsides of DCO

- more surgery
- longer stays
- potential infection risk



How to decide between ETC vs DCO

Resuscitation Before Stabilization of Femoral Fractures Limits Acute Respiratory Distress Syndrome in Patients With Multiple Traumatic Injuries Despite Low Use of Damage Control Orthopedics

Robert V. O'Toole, MD, Michael O'Brien, MD, Thomas M. Scalea, MD, Nader Habashi, MD, Andrew N. Pollak, MD, and Clifford H. Turen, MD

Resuscitation is key !!

- Lactate approaching 2.5 to suggest adequate resuscitation for IMN
 - if lactate down to 2.5 in 24hrs then IMN
 - if not adequately resuscitated then DCO = external fixation
 - rates of ARDS lower than DCO alone

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2009

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Timing of Orthopaedic Surgery in Multiple Trauma Patients: Development of a Protocol for Early Appropriate Care

Heather A. Vallier, MD, Xiaofeng Wang, PhD, Timothy A. Moore, MD, John H. Wilber, MD, and John J. Como, MD

- What if Lactate is not normalizing but improving?
- Looked at pH, BE, Lactate
- Complications: ARDS, Pneumonia, DVT
- Lactate was most specific predictor of pneumonia, more than pH
- Chest injury was strongest independent predictor of pulmonary complication
- EAC protocol
 - Fix unstable fractures within **36 hrs** as long as
 - Lactate < 4
 - BE < -5.5

Summary of Lactate

- Lactate- the most sensitive indicator of adequate perfusion
 - If normal (around 2.5 or less) within 24 hours ok to nail
 - If improving but not normal (4.0 or less) within 36 hours ok to nail
 - If higher than 4.0 ; consider Damage control orthopedics as a procedure to help patient resuscitate

Summary

- The ***timing*** and ***fixation method*** of extremity injuries in polytrauma patients will affect patient's potential recovery
 - Resuscitation is key and will guide treatment
 - Delaying fixation can have adverse outcomes
 - Early Fixation can cause a 2nd hit phenomenon
 - Damage Control Orthopedics is a tool to temporize patients as they are optimized for definitive fixation.
- Majority of polytrauma patients with femoral fractures can safely undergo intramedullary nailing in the first 24 hours ***IF*** Lactate and Base deficit normalize

References

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