

Ultra Early vs. Early vs Late Surgeries in Spinal Cord Injury: Controversies in Management

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Disclosures

- No financial disclosures
- Member of the Track-SCI research team whose work is discussed during this talk



Outline

- Background on the topic
 - Impact of Changing Demographics of SCI
 - Past Practices
 - Evidence for Change in Practice
- Evidence relating to Ultra Early vs Early vs Late Decompression following SCI

Controversies in Management

Spinal Cord Injury—What Are the Controversies?

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and Michael G. Fehlings, MD, PhD, FACS, FRCSC*†‡||¶***

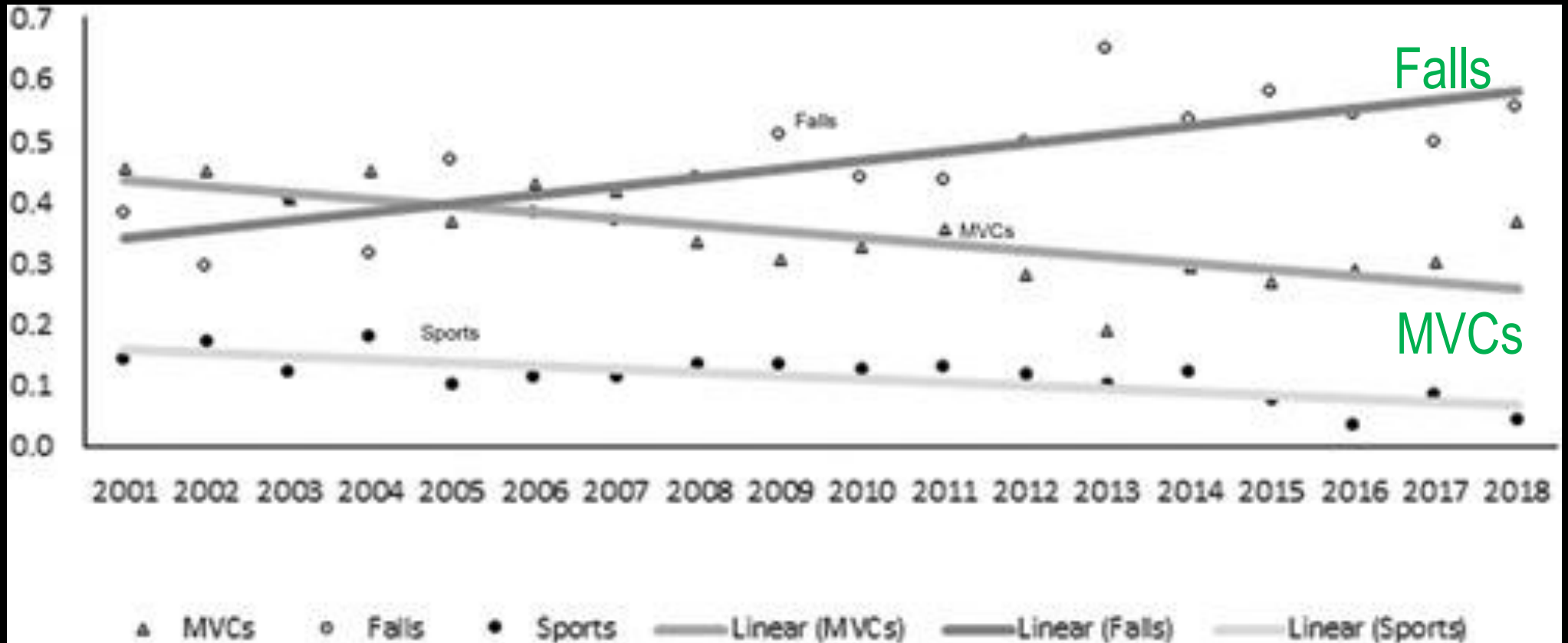
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- Timing of decompression

Early (within 24 hours) vs. Late (>24 hours)

Ultra Early (<12 hours)

Changing Demographics



Changing Demographics

Age at Injury

The average age at injury has increased from 29 years during the 1970s to 43 since 2015.

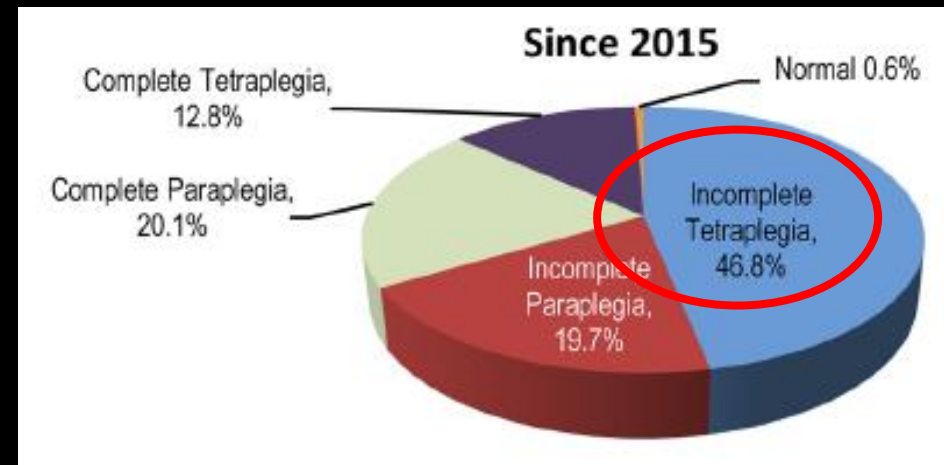
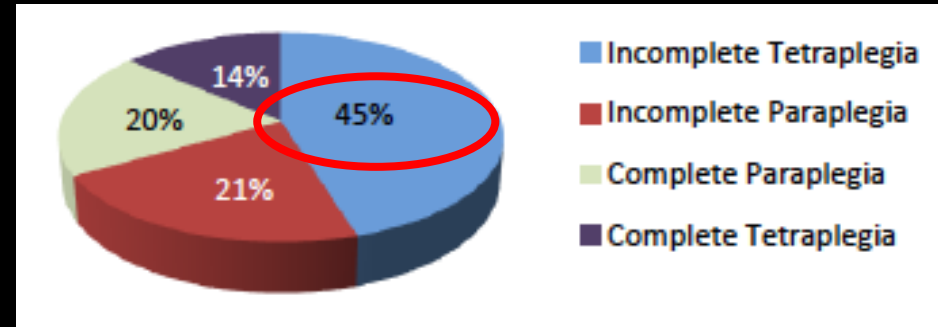
29 yo



43 yo

Changing Demographics

- **Clinical severity: reduced severity, increased number of incomplete injuries**
- Increased motor incomplete and central cord syndromes
- Fewer patients with catastrophic fracture dislocations
- More older victims with incomplete traumatic injuries (Aarabi, 2021)



BRIEF INSCSCI Review / Nomenclature

- **AIS A:** complete
- **AIS B:** incomplete (motor complete) where either DAP, VAC or sensation at S4-5 is intact
- **AIS C:** incomplete, more than $\frac{1}{2}$ of the muscles below the NLI are $<3/5$
- **AIS D:** incomplete, more than $\frac{1}{2}$ of the muscles below the NLI are $3/5$ or better
- **AIS E:** Normal

Past recommendations

THE SYNDROME OF ACUTE CENTRAL CERVICAL SPINAL CORD INJURY

BY

RICHARD C. SCHNEIDER, JOHN M. THOMPSON, and JOSE BEBIN

From the Departments of Surgery and Sections of Neurosurgery of the University of Michigan Hospital, U.S. Veterans Hospital, and St. Joseph's Mercy Hospital, Ann Arbor, Michigan, and the Wayne County General Hospital, Eloise, Michigan, and the Department of Neuropathology, University Hospital, Ann Arbor

J. Neurol. Neurosurg. Psychiat., 1958, 21, 216.

- 1951: Schneider noted that “there is, of course universal agreement that a pt with an immediate complete lesion without a block on Queckenstedt test, **should not be subjected to operation**

Past Practice

- “In patients who show the acute central cervical spinal cord injury syndrome, the prognosis is usually good” and that when “**cord oedema subsides, recovery follows...**”
- “The importance of diagnosis is stressed with emphasis placed on the fact that **operation is contraindicated**, that **prognosis may be good...**”
- Limited evidence of benefits of decompression
- Concern for risk of surgery

Past Practice

- BUT: there was an ongoing and growing body of evidence of the potential sequelae of secondary injury:
 - Compression due to bone, blood, disc fragments →
 - Ischemia
 - Neuronal death

AO Spine Recommendations

A Clinical Practice Guideline for the Management of Patients With Acute Spinal Cord Injury and Central Cord Syndrome: Recommendations on the Timing (≤ 24 Hours Versus >24 Hours) of Decompressive Surgery



Michael G. Fehlings, MD, PhD, FRCS, FACS^{1,2}, Lindsay A. Tetreault, PhD^{1,3}, Jefferson R. Wilson, MD, PhD^{2,4}, Bizhan Aarabi, MD⁵, Paul Anderson, MD⁶, Paul M. Arnold, MD⁷, Darrel S. Brodke, MD⁸, Anthony S. Burns, MD, PhD⁹, Kazuhiro Chiba, MD, PhD¹⁰, Joseph R. Dettori, PhD, MPH¹¹, Julio C. Furlan, MD, PhD, MBA², Gregory Hawryluk, MD, PhD⁸, Langston T. Holly, MD¹², Susan Howley, BA¹³, Tara Jeji, MD¹⁴, Sukhvinder Kalsi-Ryan, PhD¹, Mark Kotter, MD, PhD¹⁵, Shekar Kurpad, MD, PhD¹⁶, Ralph J. Marino, MD¹⁷, Allan R. Martin, MD, PhD¹, Eric Massicotte, MD¹, Geno Merli, MD¹⁷, James W. Middleton, MBBS, PhD¹⁸, Hiroaki Nakashima, MD¹⁹, Narihito Nagoshi, MD^{1,20}, Katherine Palmieri, MD²¹, Anoushka Singh, PhD¹, Andrea C. Skelly, PhD¹¹, Eve C. Tsai, MD, PhD²², Alexander Vaccaro, MD, PhD²³, Albert Yee, MD²⁴, and James S. Harrop, MD²⁵

- Interdisciplinary, systematic review
- Rigorous look at outcomes
 - Improvement in AIS motor score
 - Improvement in FIM score
 - Improvement in SCIM

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- Considered:
 - Risk of surgery
 - Complications
 - Cost effectiveness
 - Availability of resources / feasibility
- Weighed in based on expertise when limited data existed

AO Spine Recommendations



We **suggest** that early surgery (<24 hours after injury) be considered as a treatment option in adult pts with **traumatic central cord syndrome**.

Quality of evidence: low

Strength of rec: weak

We **suggest** that early surgery be offered as an option for adult **acute SCI pts regardless of level**.

Quality of evidence: low

Strength of rec: weak

Ultra Early vs. Early vs. Late

Ultra-Early (<12 Hours) Surgery Correlates With Higher Rate of American Spinal Injury Association Impairment Scale Conversion After Cervical Spinal Cord Injury

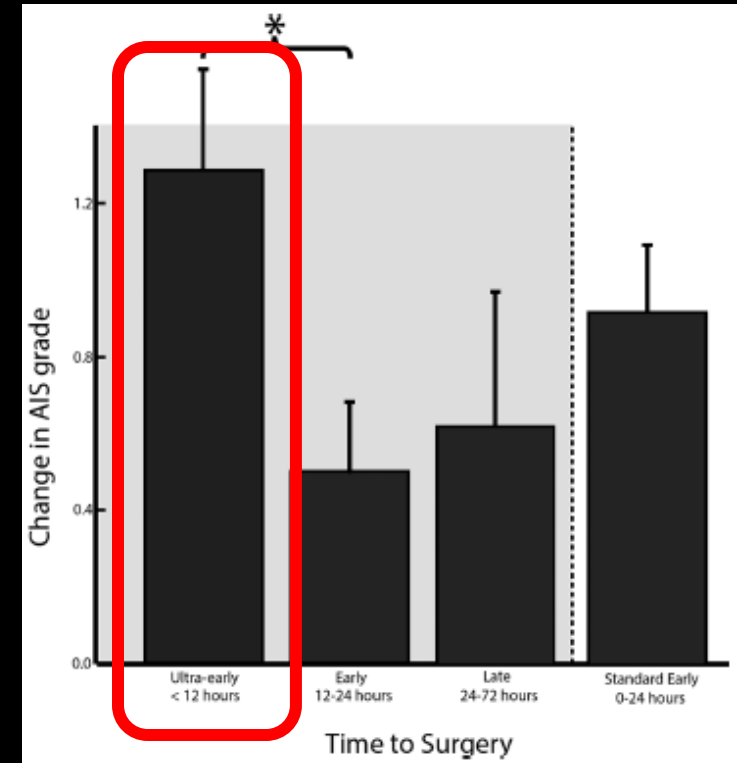
- Burke et al 2018, retrospective cohort study
- N=48
 - Ultra early (< 12 hours): 18
 - Early (12-24 hours): 17
 - Late (>24 hours): 13
- No significant difference in admission AIS grade or ISS score in each category
- Admission AIS grade compared to DC AIS grade

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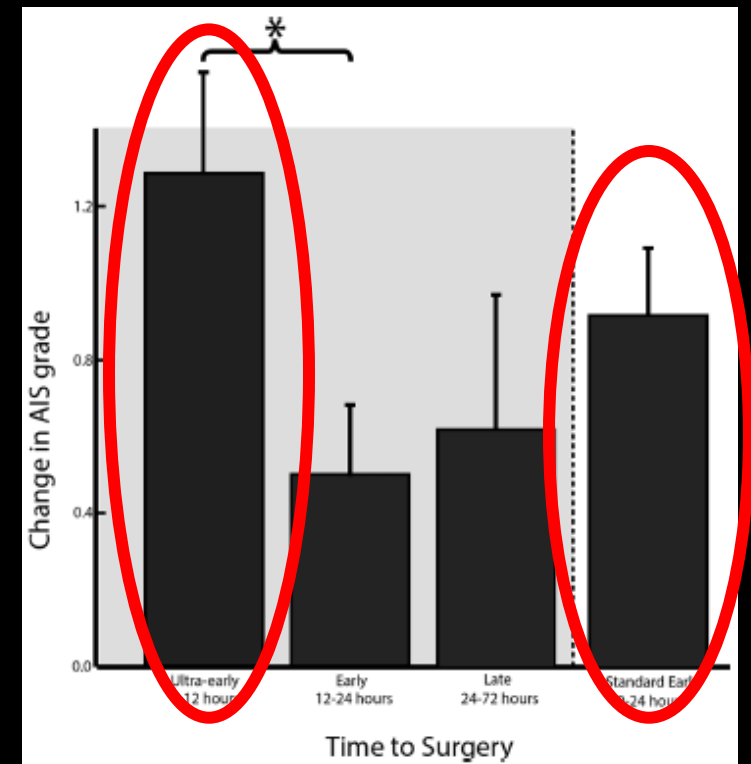
Ultra Early vs. Early vs. Late

- Improvement in AIS grade:
 - Ultra early (< 12 hours): 1.3
 - Early (8-24 hours): 0.5
 - Late (>24 hours): 1.3
- Significant improvement in AIS grade for ultra early compared to early surgery (P=.02)
- No significant improvement in AIS grade was noted in the early or late group



Ultra Early vs. Early vs. Late

- When combining the ultra early and early groups (“traditional early group”), there was no significance difference between this group and the late group ($P=.40$)
- Authors feel that this suggests that the benefit from early decompression occurs within 12 hours after injury



Ultra Early vs. Early vs. Late

**Letter: Ultra-Early (<12 Hours) Surgery
Correlates With Higher Rate of American
Spinal Injury Association Impairment Scale
Conversion After Cervical Spinal Cord Injury**

**In Reply: Ultra-Early (<12 Hours) Surgery
Correlates With Higher Rate of American
Spinal Injury Association Impairment Scale
Conversion After Cervical Spinal Cord Injury**

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“...given the current evidence, if one of our family members had an SCI, we would choose the ultra early surgery approach ... until proven otherwise.”

Ultra Early vs. Early vs. Late

Efficacy of Ultra-Early (< 12 h), Early (12–24 h), and Late (>24–138.5 h) Surgery with Magnetic Resonance Imaging-Confirmed Decompression in American Spinal Injury Association Impairment Scale Grades A, B, and C Cervical Spinal Cord Injury

Bizhan Aarabi,^{1,2} Noori Akhtar-Danesh,³ Timothy Chryssikos,¹ Kathirkamanathan Shanmuganathan,² Gary T. Schwartzbauer,^{1,2} J. Marc Simard,¹ Joshua Olexa,¹ Charles A. Sansur,¹ Kenneth M. Crandall,¹ Harry Mushlin,¹ Matthew J. Kole,¹ Elizabeth J. Le,¹ Aaron P. Wessel,¹ Nathan Pratt,¹ Gregory Cannarsa,¹ Cara Lomangino,² Maureen Scarboro,² Carla Aresco,² Jeffrey Oliver,¹ Nicholas Caffes,¹ Stephen Carbine,¹ and Kanami Mori¹

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Mary Ann Liebert, Inc.
DOI: 10.1089/neu.2019.6606

Literature review noting a 50/50 split with studies supporting early surgery.

Ultra Early vs. Early vs. Late

- N=72, retrospective cohort
- Admission AIS A, B and C, follow up at 6 mos
- Ultra Early vs. Early vs. Late
- **Pre-op and post-op IMLL** (intermedullary lesion length) on MRI to measure the extent of spinal cord compression.
 - **Decompression had to span the IMLL – if it did not, then this would confound any results related to the timing of surgery**
 - Pts with inadequate decompression based on post op IMLL were not included.

Ultra Early vs. Early vs. Late

- AIS grade improvement:
 - Ultra Early: 65.6,%
 - Early: 60%
 - Late: 80% of pts
 - It was not time to surgery that impacted outcome.
 - Instead, it was Pre-Op IMLL (and subsequent appropriate decompression) that had the most powerful effect on AIS grade conversion and thus neurological outcome.

Ultra Early vs. Early vs. Late

“...therapeutic effectiveness of time (early vs. late) of surgical decompression and its relationship with neurological outcome ... is at equipoise.”

"clinical equipoise," the requirement is satisfied if there is genuine uncertainty within the expert medical community--not necessarily on the part of the individual investigator--about the preferred treatment.

Ultra Early vs. Early vs. Late

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Letter to the Editor

“...if that were true, then all emergent efforts to stabilize cervical injuries should be abandoned.”

Ultra Early vs. Early vs. Late

- Literature review: 100% of the studies that in the article that were prospective and defined Early surgery as <24 hours were in support of early surgery
- 90% of the pts with AIS A and B fell into the ultra early and early group, thereby potentially impacting rate of AIS conversion
- Overall, Burke et al recommended keeping to the AO Spine guidelines where early decompression is the preferred option

Ultra Early vs. Early

Ultra-early Spinal Decompression Surgery Can Improve Neurological Outcome of Complete Cervical Spinal Cord Injury; a Systematic Review and Meta-analysis

Mahmoud Yousefifard¹, Behrooz Hashemi², Mohammad Mehdi Forouzanfar³, Rozita Khatamian Oskooi⁴, Artan Madani Nelshaboort^{1*}, Reza Jalili Khoshnoud^{5†}

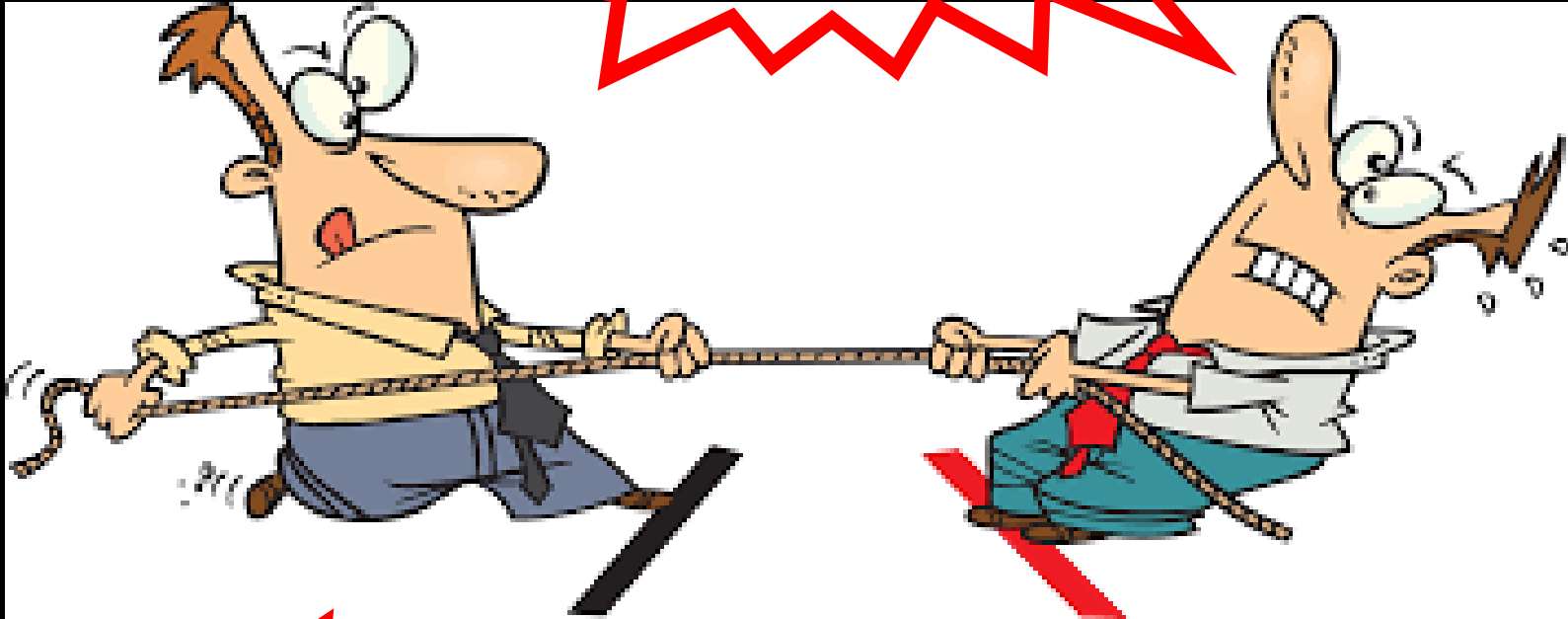
Archives of Academic Emergency Medicine. 2022; 10(1): e11

- 16 articles, 868 pts (cohort studies and clinical trials)
- Outcomes were odds ratios and confidence interval
- Ultra Early, Early and Late groups were studied

Ultra Early vs. Early

- Results:
 - 2 significant findings in **favor** of Ultra Early Surgery:
 - Decompression significantly improved AIS grades in cervical injuries
 - In pts with baseline AIS A, neurologic improvement increased up to 3.86 fold
 - **However, early surgery did not appear to impact recovery in AIS B, C and D** and that **postponing** decompression surgery to 24 hours in these pts **did not** significantly affect neuro outcome

TIME IS SPINE



ULTRA EARLY

EARLY

Thank You



Orthopaedic Trauma Institute

UCSF + SAN FRANCISCO GENERAL HOSPITAL