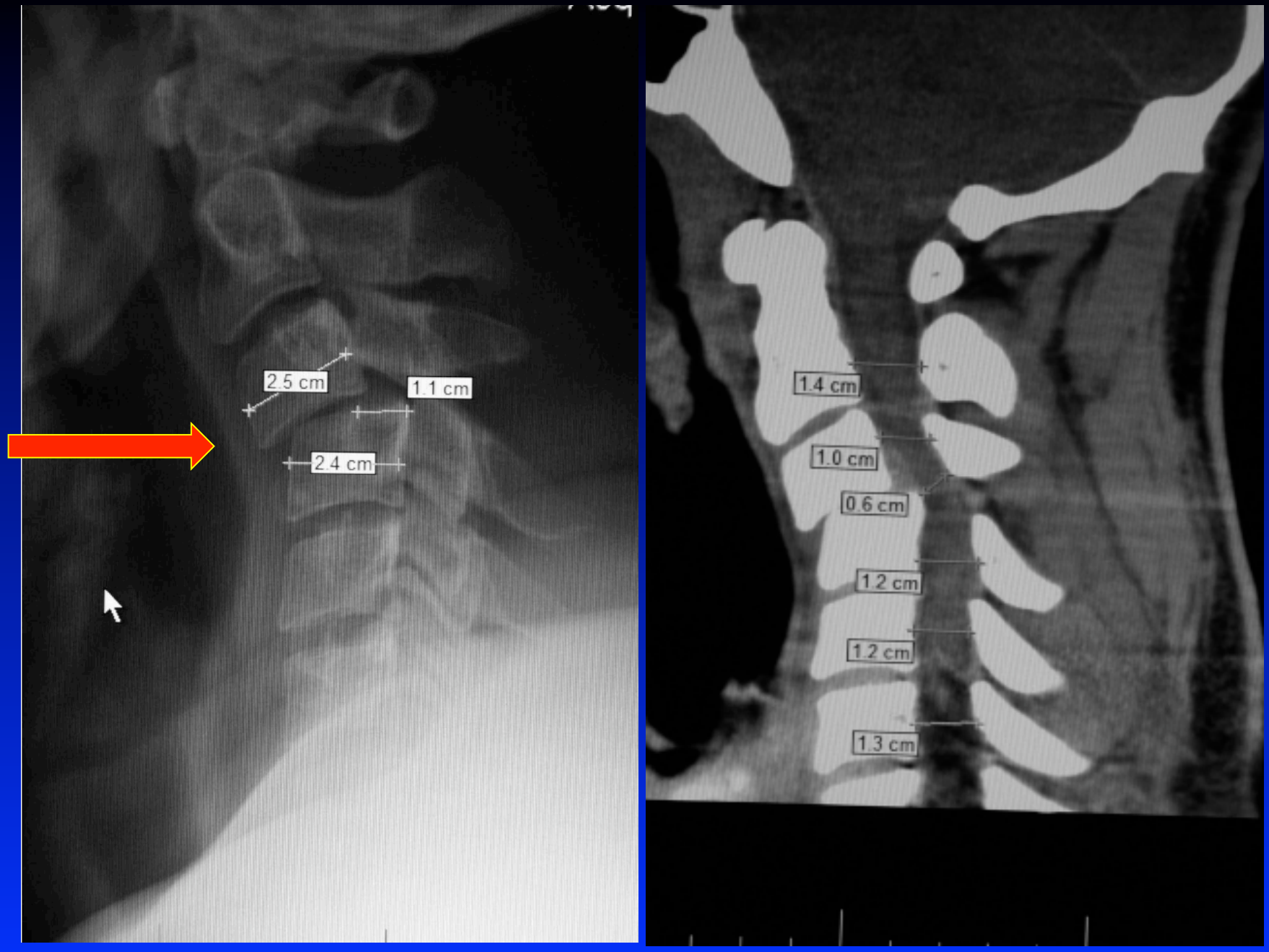
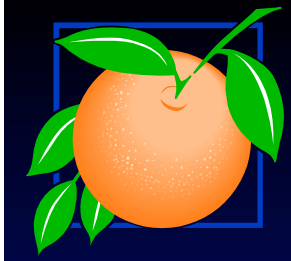
Therapeutic Hypothermia and Spinal Cord Injury

George Ralls MD, FACEP
Orange County EMS System
Eagles 2010


SC
SUNDOWN
KEVIN EVERETT
GIANTS COWBOYS
THE BLITZ
PATRIOTS JETS
RANDY MOSS
PATRIOTS DOMINATE
BEARS CHARGERS
NFL
CLE
4 rec, 83 yds
ESPN


2


2.5 cm
1.1 cm
2.4 cm
1.4 cm
1.0 cm
0.6 cm
1.2 cm
1.2 cm
1.3 cm

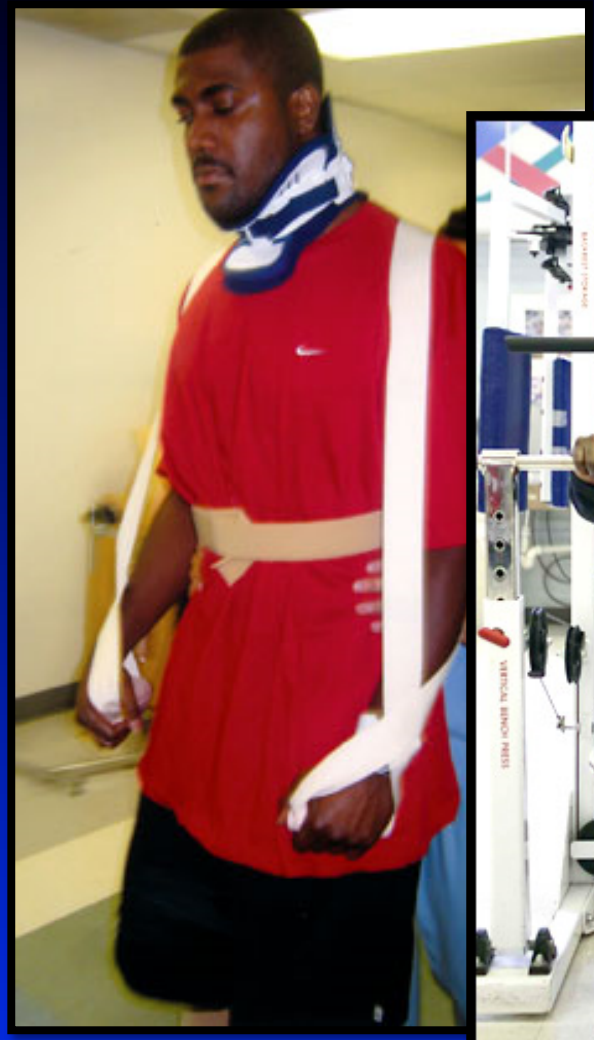


Spinal Immobilization, IV, O2

Cooling interventions immediately

IV steroids (Methylprednisolone)

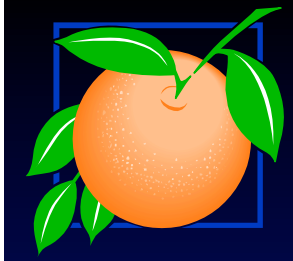
Early surgical decompression (3 hrs)



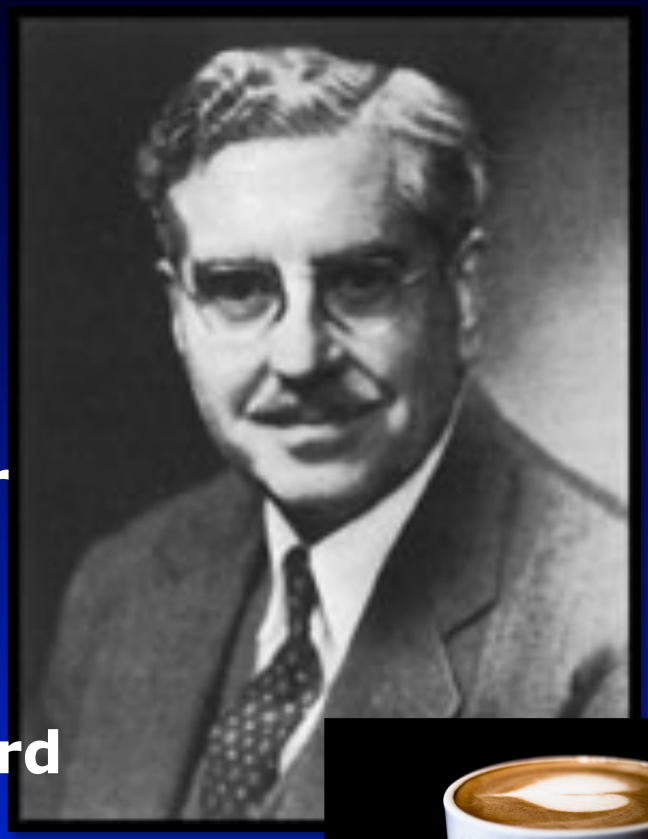

AIR JORDAN


BILLS

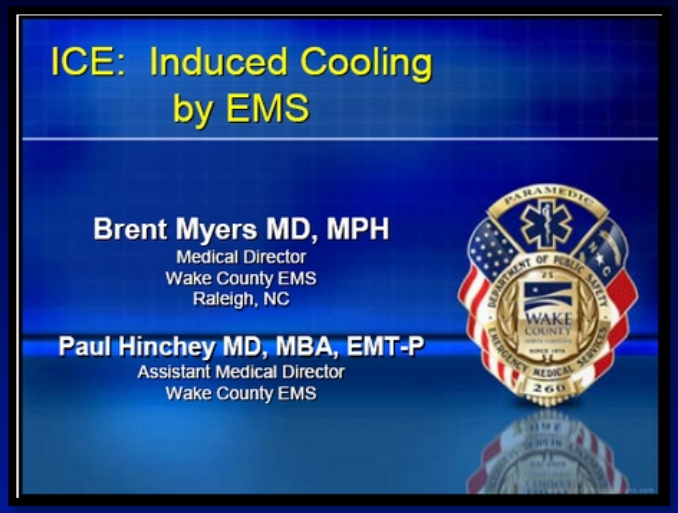
Dan O'Reilly
"The Miracle Man"



- **1937 Dr. Temple Fay**
  - Cancer Treatment
- **1950's**
  - Cerebral aneurysm repair
  - 24° C – 33°C
- **1960-70's**
  - Local cooling of spinal cord
  - Traumatic SCI
- **1980's**
  - Interest dwindled due to concern about complications

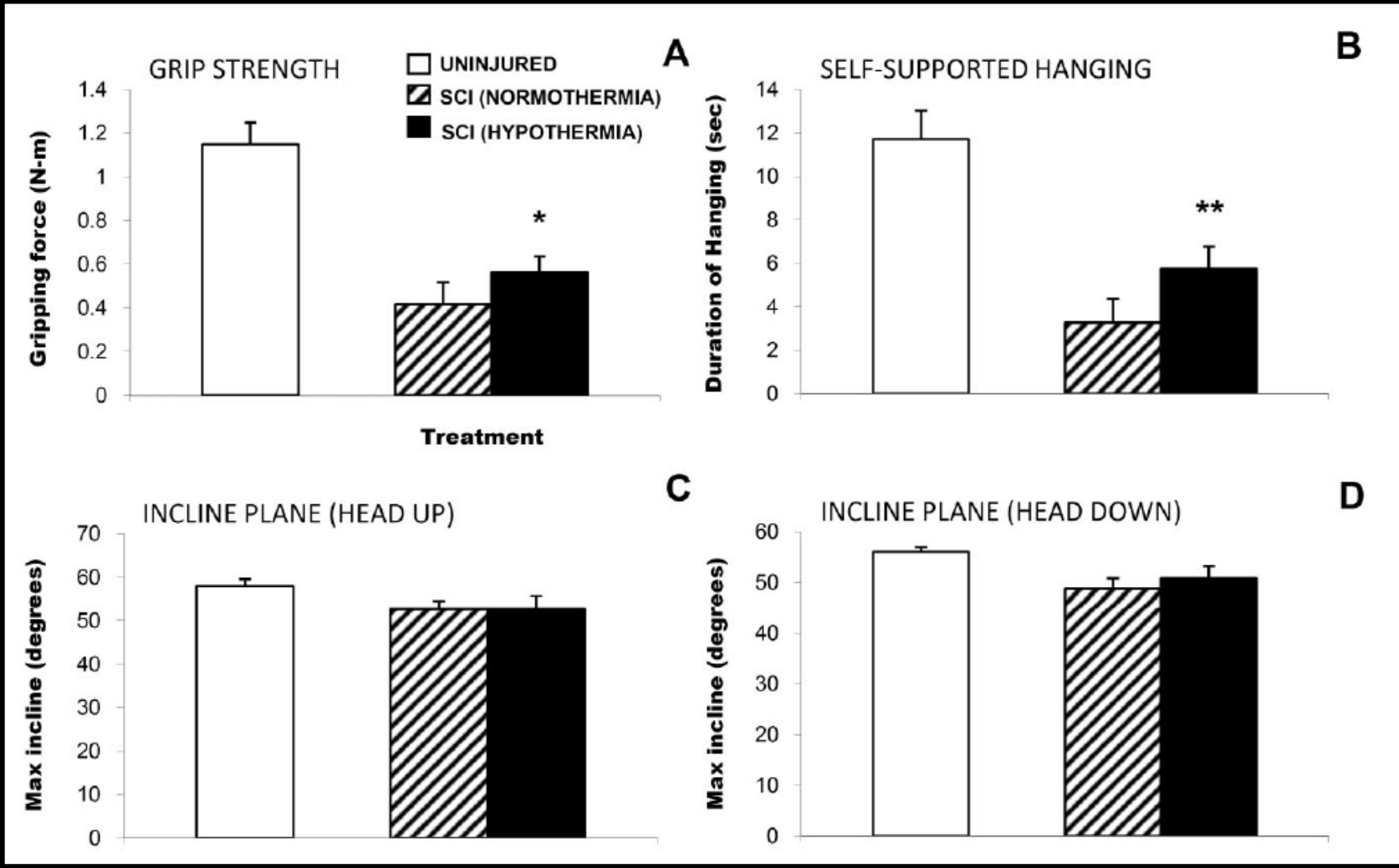


- **2002**
  - **NEJM**
    - **HACA Trial and Bernard studies**
- **2006**
  - **Systematic Literature Review (CJEM)**
- **2007**
  - **Kevin Everett Story**



First Author (Reference)	Species	Level	Method	Cooling Start	°C Duration	Other	Outcome
Albin (41)	Dog	T10	WD	0 hrs	12 SC, 2.5 hrs	DO	Positive
Albin (42)	Monkey	T10	WD	4 hrs post	10 SC, 3 hrs	DO	Positive
Ducker (56)	Dog	T11	WD	3 hrs post	3 SOL, 3 hrs	DO	Positive
Kelly (57)	Dog	T10	WD	0 hrs	12 SC, 2.5 hrs	DO	Positive
Black (58)	Monkey	T10	WD	1 hrs post	4–8 SOL, 5 hrs	±DO	Negative
Tator (14)	Monkey	T9–10	ICD	3 hrs post	5, 3 hrs	±DO	Positive
				3 hrs post	36, 3 hrs	±DO	Positive
Campbell (59)	Cat	T9	WD	3 hrs post	4 SOL, 3 hrs	DO	Positive
Hansebout (15)	Dog	T13	ICD	0 hrs	4 EP, 4 hrs		Positive
Kuchner (52)	Dog	T13	ICD	15 mins post	6 SOL, 4 hrs		Positive
Eidelberg (60)	Ferret	Mid-T	SWL	1 hr post	10 EP, 3 hrs		Positive
Wells (61)	Dog	T13	ICD	4 hrs post	6 EP, 1–18 hrs		Positive
Green (43)	Cat	T10	WD	1.4 hrs post	6–18°C, 3 hrs	DO	Positive
Martinez-Arizala (17)	Rat	T8	WD	Pre & post	31–32°C, 4 hrs	DI	Positive
Yu (18)	Rat	T10	WD	Post	33°C, 4 hrs	DI	Positive
Chatzipanteli (47)	Rat	T10	WD	Post	33°C, 4 hrs	DI	Positive
Dimar (39)	Rat	T10	WD	Post	19°C, 2 hrs	DI	Positive/
Lo (21)	Rat	C5	WD	Post	33°C, 4 hrs	DI	Positive

W. Dalton Dietrich, III, PhD Crit Care Med 2009 Vol. 37, No. 7 (Suppl.)



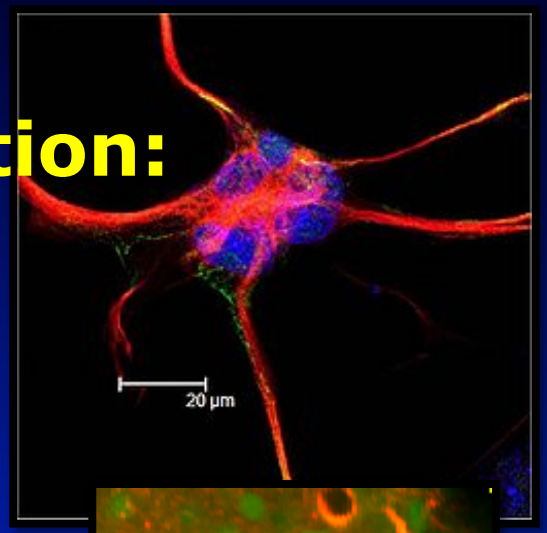
Pang, et. al. The Journal of Comparative Neurology 514:433–448 (2009)

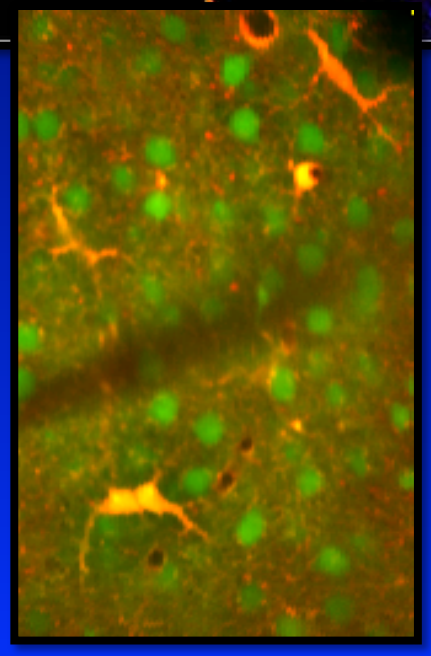
Hypothermia is Neuroprotective

- Cardiac arrest
- Traumatic brain injury
- Stroke/SAH
- Thoracic Aortic Aneurysm repair
- Cold water drowning

Mechanism of Neuroprotection:

- Suppression of injury induced inflammation
- Suppression of gliosis
- Reduces oxygen free radical production
- Reduces overall metabolic demand





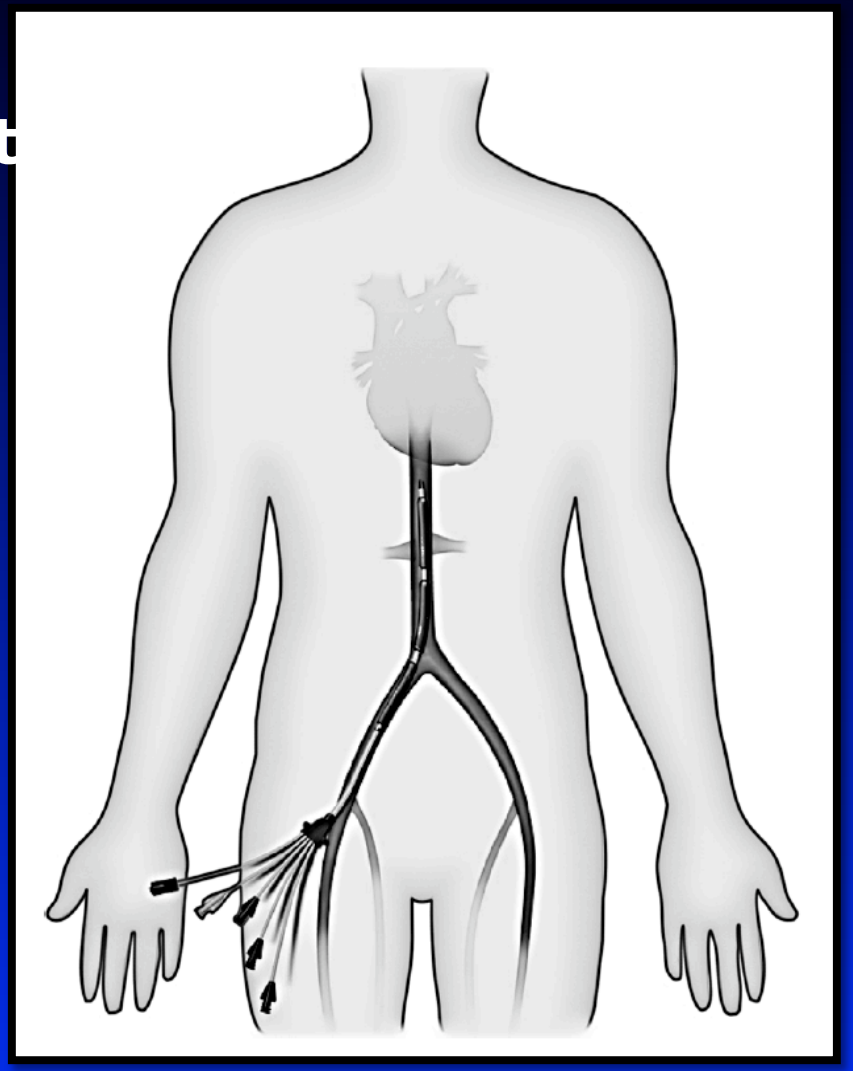
- **Human Studies:**
  - **2009 Levi, et al**
  - **Retrospective analysis**
  - **14 patients**
  - **Safety study**

Levi, et al JOURNAL OF NEUROTRAUMA 26:407–415 (March 2009)

- First patient enrolled in 2006
- Acute C-SCI
- Complete SCI/Non-penetrating
- Injury confirmed by radiography
- Cleared by trauma service for other injuries

Levi, et al JOURNAL OF NEUROTRAUMA 26:407–415 (March 2009)

- **Intravascular Cathet**
- **Target temp: 33°C**
- **Time to Initiation:**
  - **3-33 hours**
  - **Mean 9 hr 10 min**
- **Duration:**
  - **48 hours at target**



Levi, et al JOURNAL OF NEUROTRAUMA 26:407–415 (March 2009)

TABLE 3. SUMMARY OF COMPLICATIONS IN PATIENTS THAT RECEIVED HYPOTHERMIA

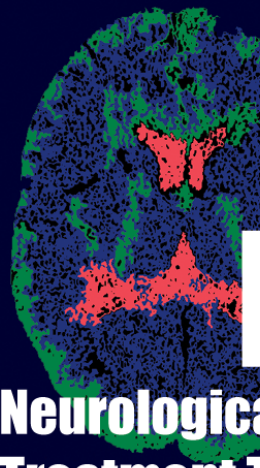
Complication	*N*	%
Atelectasis	12	85.7
Pneumonia	8	57.1
ARDS	2	14.3
Arrhythmia	3	21.4
Thrombocytopenia	1	7.1
Sepsis	1	7.1
Coagulopathy	0	0.0
DVT	0	0.0
MI	0	0.0
PE	0	0.0
Wound infection	0	0.0
Death	0	0.0

Levi, et al JOURNAL OF NEUROTRAUMA 26:407–415 (March 2009)

- 6 month Follow-up of the original 14 patients
  - Currently in peer review process

- NIH Grant (Dr. Wang)
  - Multicenter Prospective Controlled Trial
  - NETT

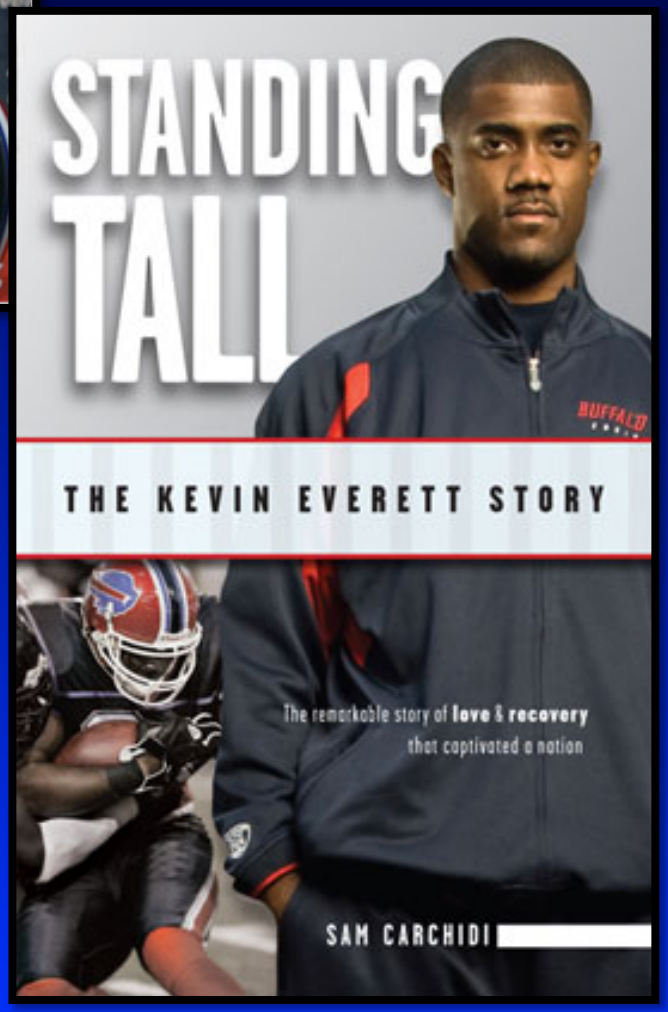
THE MIAMI PROJECT TO CURE PARALYSIS



NETT
Neurological Emergency Treatment Trials

What Role do We Play?

"The extent to which this hypothermia contributed to his neurologic recovery is difficult to determine."



- **Not widely adopted by Trauma and Neurosurgical community yet**
- **Animal models not representative of most trauma patients**
- **Paucity of human research**
- **Multicenter RCT planned**

Induced Hypothermia and Spinal Cord Injury

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