Management of Catastrophic Brain Injury

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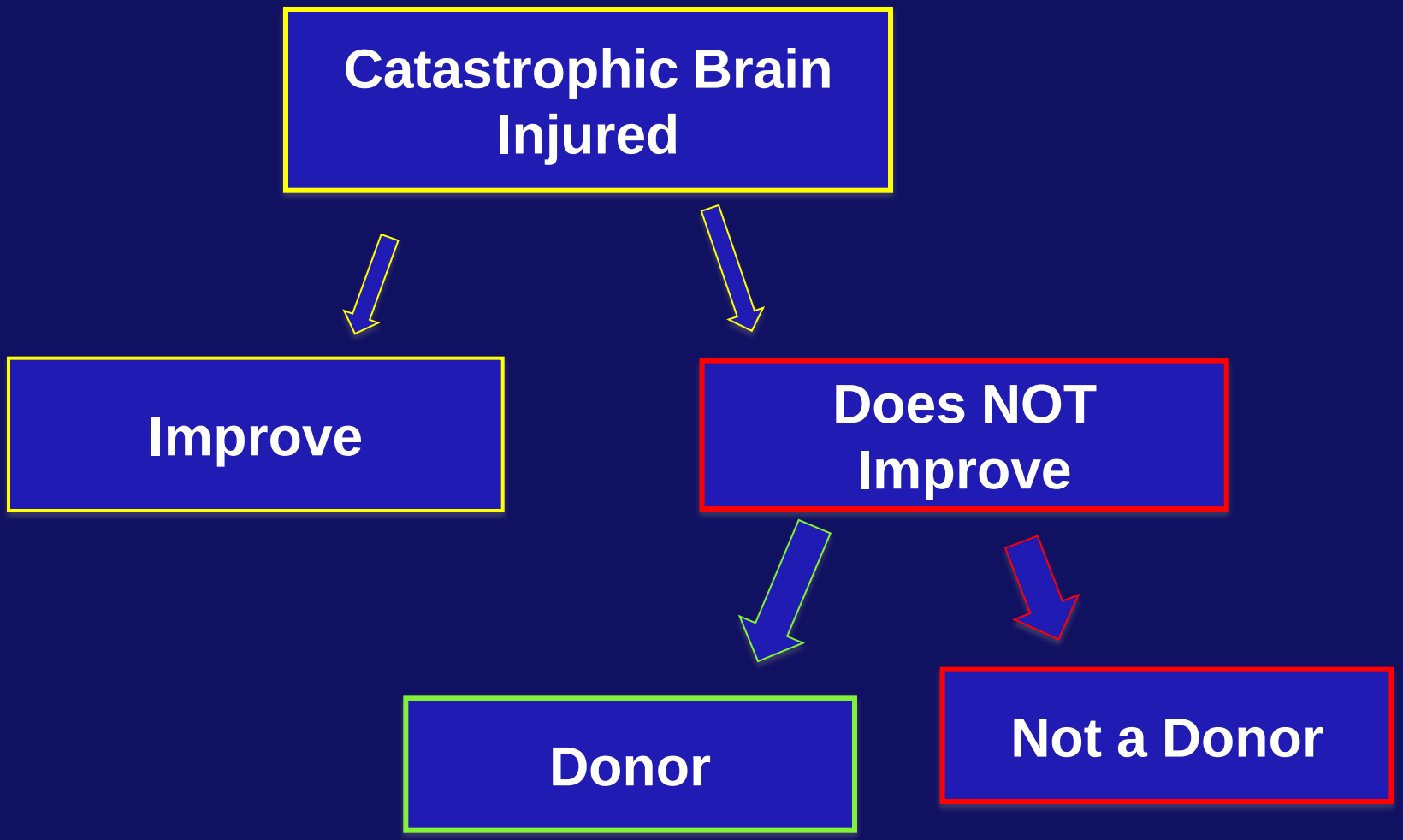
Catastrophic Brain Injury

- Blunt, polytrauma patients
- Multiple injuries
- CT scan consistent with herniation or impending herniation
- Neurosurgery deems injury non-survivable

Catastrophic Brain Injury

- Protect the brain
- Early Intensive Care Management


Catastrophic Brain Injured
Improve
Does NOT Improve
Donor
Not a Donor

Catastrophic Brain Injury

GOAL is to decrease Intracranial Pressure

- HOB elevation
- C-collar too tight
- Pain control/sedation
- Intubation
- Hyperventilation

- Resuscitation…..

Catastrophic Brain Injury

Cerebral perfusion

Catastrophic Brain Injury

hyperventilation

>> decrease pCOs

>> vasoconsriction

>> decrease arterial volume

>> **decrease ICP**

Catastrophic Brain Injury

- Resuscitation fluid
- Isotonic vs. hypertonic saline

Hypertonic Saline

- 250-500 cc (4cc/Kg)
- 5 minute infusion
- 3 - 7.5%
- +/- Dextran 6%

Hypertonic Saline

- Animal studies support improved microcirculatory flow

- Increases
  - Intravascular volume
  - Osmolarity
  - Brain perfusion

Hypertonic Saline

- Decreases
  - Pro inflammatory cytokines
  - Capillary permeability
  - Brain edema

- Diminish biomarkers
  - Suggest mitigation of brain injury
  - S100, enolin

Baker AJ et al. J Neurotrauma 2009

Hypertonic Saline
Human, Animal and Cell Studies

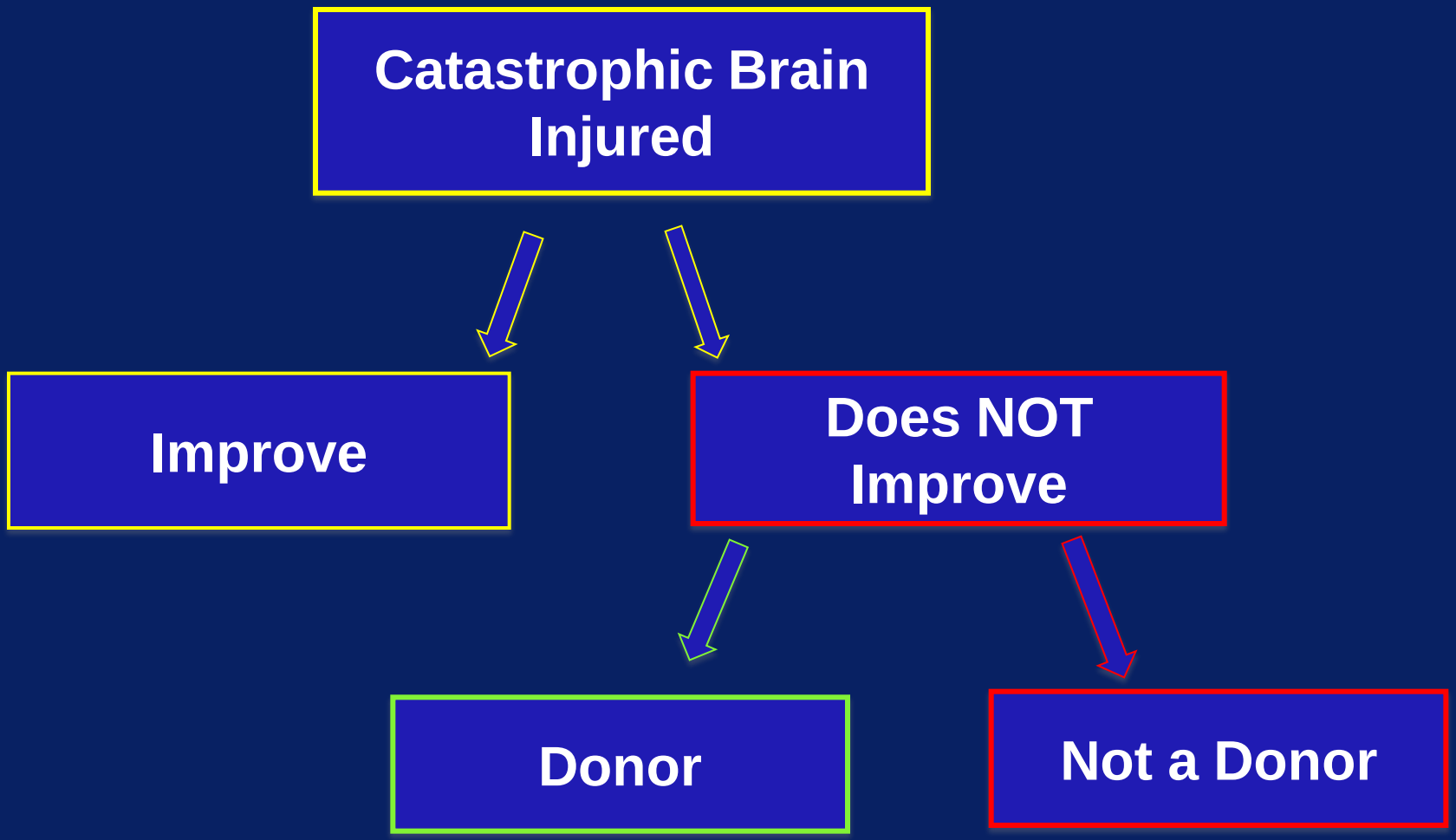
- Decreased *PRO* and increased *ANTI*-inflammatory cytokines
- Renders Neutrophil unable to adhere and cause injury
- Mediated by cell shrinkage

Rizoli S, et al. Ann Surg, 2006.

Hypertonic Saline Summary

- Safe
- Equivalent to isotonic crystalloid as volume expander
- Promising immunomodulatory role

Intensive Care Management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Catastrophic Brain Injury Guidelines "CBIG"

- SBP>90
- UOP >1ml/kg/hr
- PO_2>100
- pH 7.35-7.45

- Electrolytes
- Glucose
- Coagulation
- Normothermia

Hormone Depletion

- Herniation leads to CV deterioration
- Impaired cellular oxygen use
  - Aerobic → anaerobic metabolism
  - Increased lactate
  - Depletion of energy stores
- Associated with hypothyroid state

Endocrine Deficiency

- Cortisol
- ADH
- Insulin

Hormone Replacement Protocol

- 1 amp D50
- 2g Solumedrol
- 20 units regular insulin
- 20 mcg Thyroxine
  - Start drip 10mcg/h, titrate up
  - Monitor K+

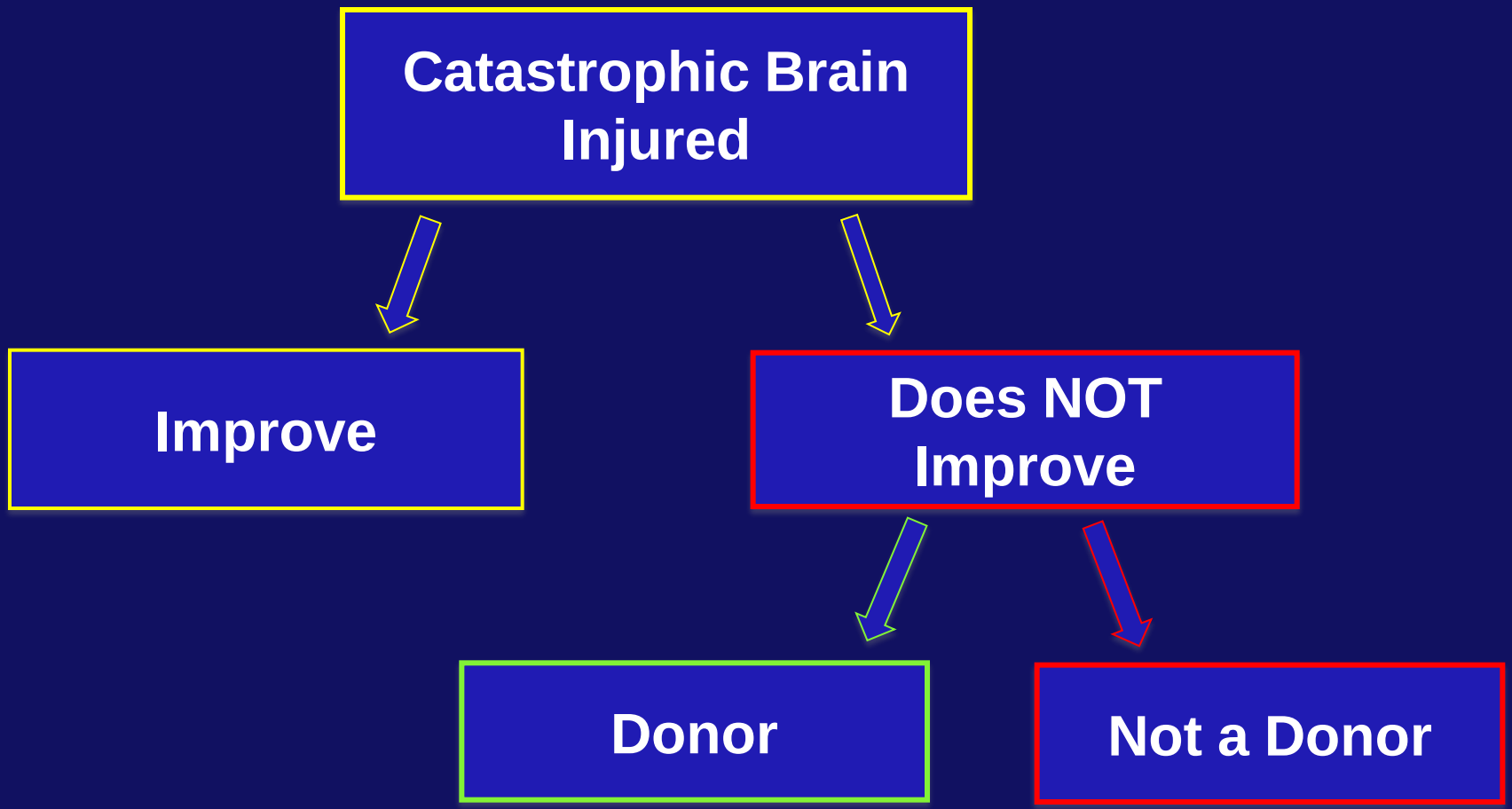
The role of thyroid hormone administration in potential organ donor

- Prospective study, N=19
- *Hypothesis*: T4 therapy will reverse the hemodynamic instability and prevent CV collapse in brain-dead patients who are potential organ donors
- Donors optimized on institution protocol and hormonal replacement after failure

Salim A, et al. Arch Surg 2001

The role of thyroid hormone administration in potential organ donor

Salim A, et al. Arch Surg 2001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Organ Donation

- Remains a national crisis
- National call for improvement

- 128,562 waiting
- **18 deaths/ day while waiting**

UNOS database, 2013

Organ Donation

- Organ Donor Collaborative
- Public Education
- Registries
- **40%** of adult population registered to donate

Organ Donor Collaborative

- 2003
- Health and Human Services recognized the organ shortage

- GOAL: dramatically increase access to transplantable organs
  - Increase number of donors
  - Increase organ transplanted per donor (OTPD)

Table 8 Key leadership organizations involved in organ donation

American Association of Critical-Care Nurses

American Society of Transplantation

American Society of Transplantation

American Society of T

JCAHO

Association of Organ tions

American Hospital Association

American Hospital Association

Institute for Healthcare Improvement

Neurocritical Care Society

National Kidney Foundation

Society for Critical Care Medicine

Quality Reality Checks, Inc

Society for Critical Care

UNOS

United Network for Org

Organ Donor Collaborative

- Identified 80% donors in 20% hospitals in the US
- 9/2003-5/2005
  - Implemented best practice
  - OPO

Collaborative Goals

Measurement	Goal
Conversion rate, %	75%
Medical examiner denials, #	0
Referral rate, %	100%
Timely notification rate, %	100%
Appropriate requester rate, %	100%

Organ Donation Conversion rate

Authorize / Approach

Increased

Organ Donation rates

Total Number Organs Donated:

Increased

Collaboration

OPO and Intensivists

Donor Management Goals (DMG)

Donor Management Goals	Parameters
Mean Arterial Pressure	60-110 mmHg
Central Venous Pressure	4-10 mmHg
Ejection Fraction	>50%
Vasopressors	≤1 and low dose
Arterial blood gas pH	7.3-7.45
PaO_2:FiO_2	>300
Serum Sodium	135-155 mEq/L
Blood Glucose	<150 mg/dL
Urine Output	0.5-3 ml/kg/hr over 4 hours

The Impact of Meeting Donor Management Goals on the Number of Organs Transplanted per Donor: Results from the United Network for Organ Sharing Region 5 Prospective Donor Management Goals Study

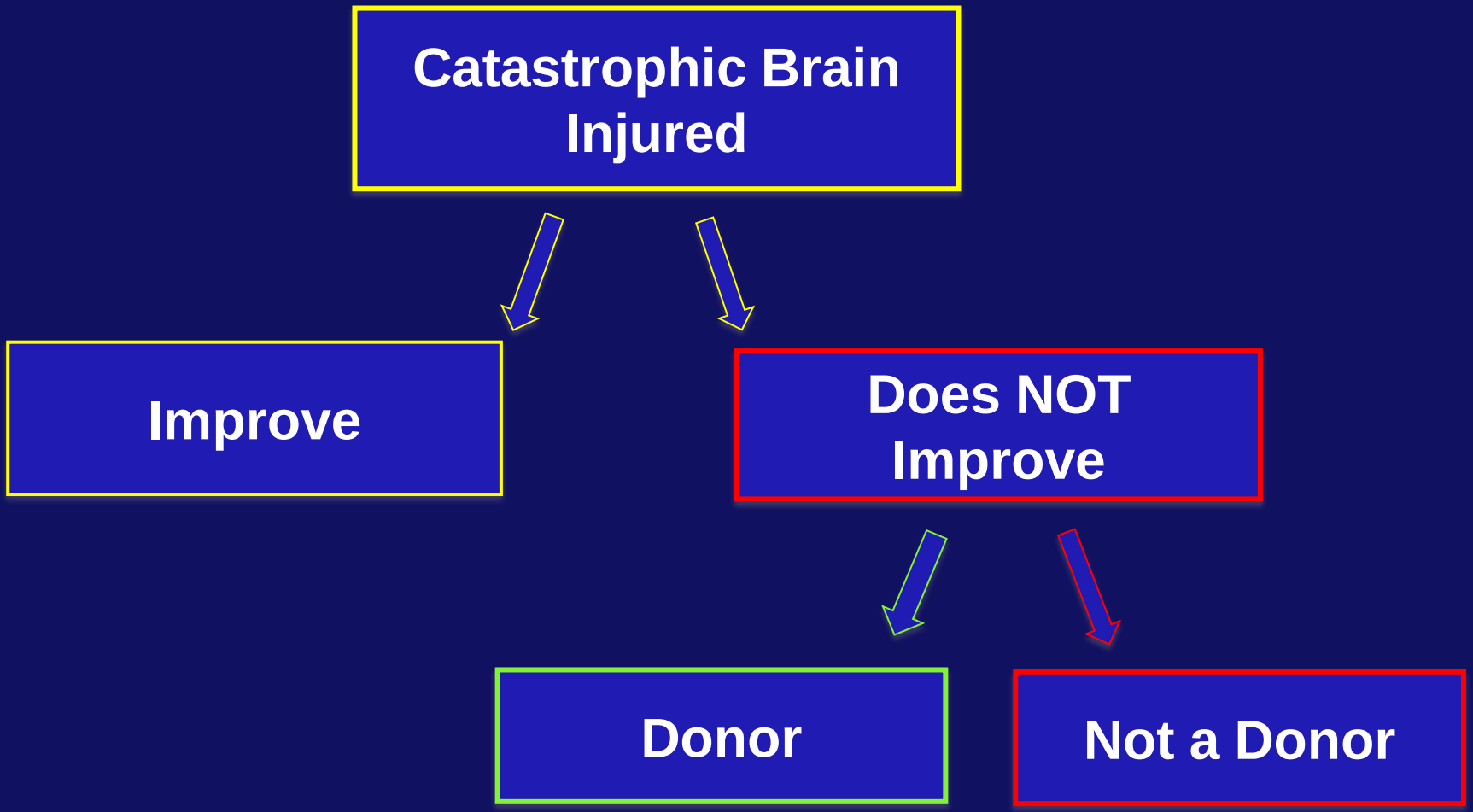
Malinoski DJ, et al; on behalf of the UNOS Region 5 DMG workgroup
Crit Care Med 2012

Optimization of Donor Management Goals Yields Increased Organ Use

Franklin GA, et al. Am Surg 2010

Donors

Stable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Summary

- Recognition of Catastrophic Brain Injured patients
- Prompt ICU care
- Take care of the patient first
- Potential for Organ Donation

Cardiac Output

ICU Management

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