DONOR MANAGEMENT
Heart & Lung

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Critical Issues

- Complications of Brain Death
  - Hypotension
  - Diabetes insipidus
- Managing Complications
- Donor Management Protocol

Brain Death

Table 1. Incidence of Pathophysiologic Changes After Brain Stem Death

Hypotension	81%
Diabetes insipidus	65%
Disseminated intravascular coagulation	28%
Cardiac arrhythmias	25%
Pulmonary edema	18%
Metabolic acidosis	11%

Smith, J Heart Lung Transplant 2004

Hypovolemia

- Absolute hypovolemia
  - Initial injury
    - Inadequate resuscitation
    - Fluid leaking into interstitial space
    - Decreased intravascular oncotic pressure after crystalloid resuscitation
  - Treatment for intracranial pressure
    - Fluid restriction
    - Urea
    - Diuretics
    - Mannitol
  - Hyperglycemia-induced osmotic diuresis
  - Diabetes insipidus
  - Hypothermic "cold" diuresis
- Effective hypovolemia
  - Loss of vasomotor tone and pooling in venous capacitance bed
  - Hypothermia treated with rewarming

Cardiac dysfunction

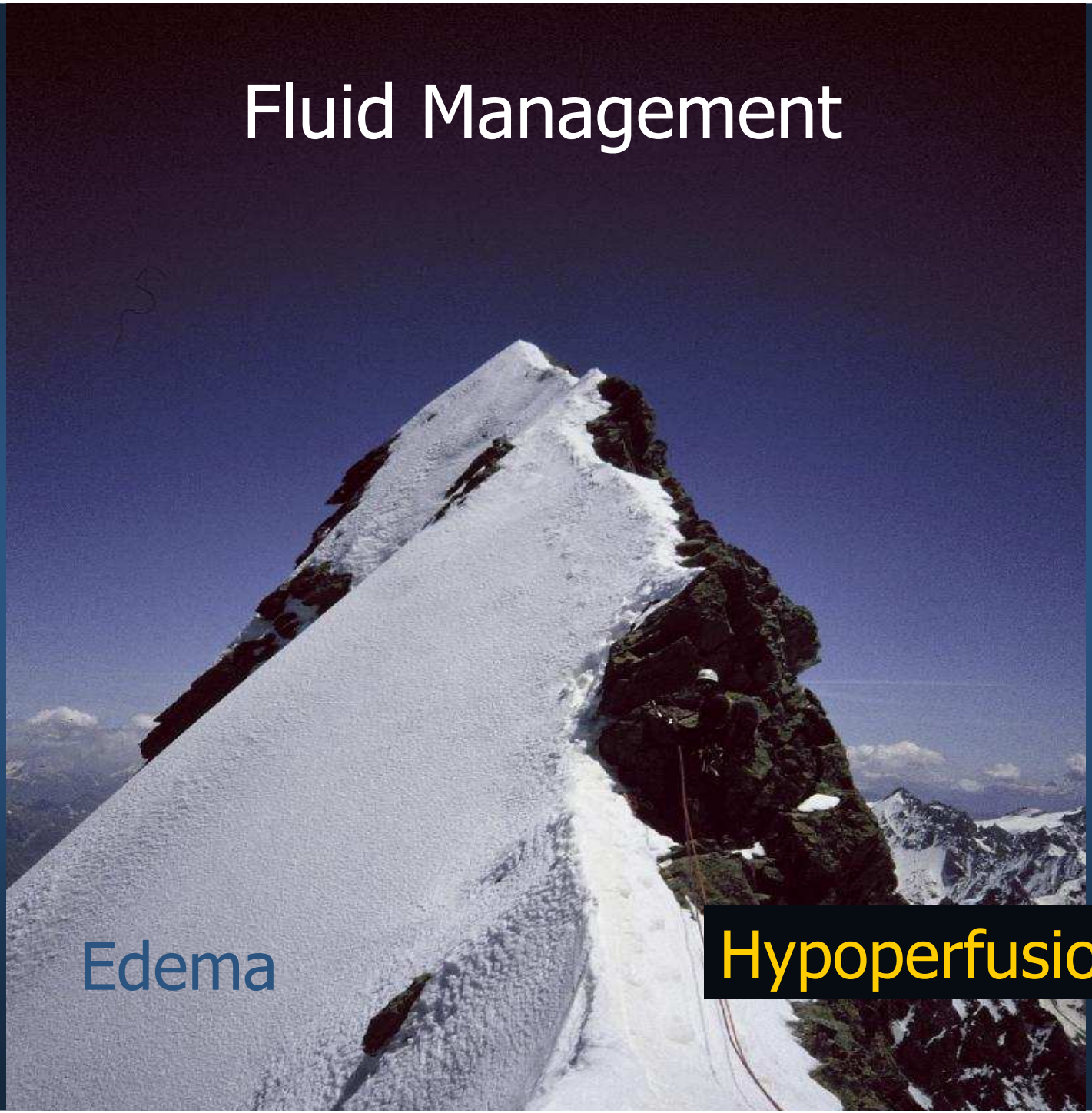
- Preexisting disease
- Initial injury
  - Myocardial contusion
  - Pericardial tamponade
  - Myocardial ischemia or infarct
- Process of brain death
  - Catecholamine damage
  - Ischemia–reperfusion injury
- Metabolic depression
  - Acidosis
  - Hypothermia
  - Hypophosphatemia
  - Hypocalcemia
  - Hypoxia
  - Endocrinopathy of brain death
- Volume overload resulting in congestive heart failure
- Arrhythmias
  - Catecholamines
  - Ischemia
  - Hypokalemia
  - Hypomagnesemia

Vasodilatation

- Spinal shock
- Catecholamine depletion
- Loss of vasomotor control and autoregulation
- Relative adrenal insufficiency as a result of trauma or critical illness
- Endocrinopathy of brain death
- Acquired sepsis

Wood, NEJM 2004

Fluid Management



The Best Fluid

	Na mmol/l	Cl mmol/l
Ringer´s Lactate	133	112
Ringer´s Solution	147	155
Saline 0,9%	154	154
HES	154	154
Albumin	154	154
Glucose	0	0

Too much Saline

- Hypernatremia
  - Cardiac function
- Hyperchloremic Metabolic Acidosis
  - Renal vasoconstriction

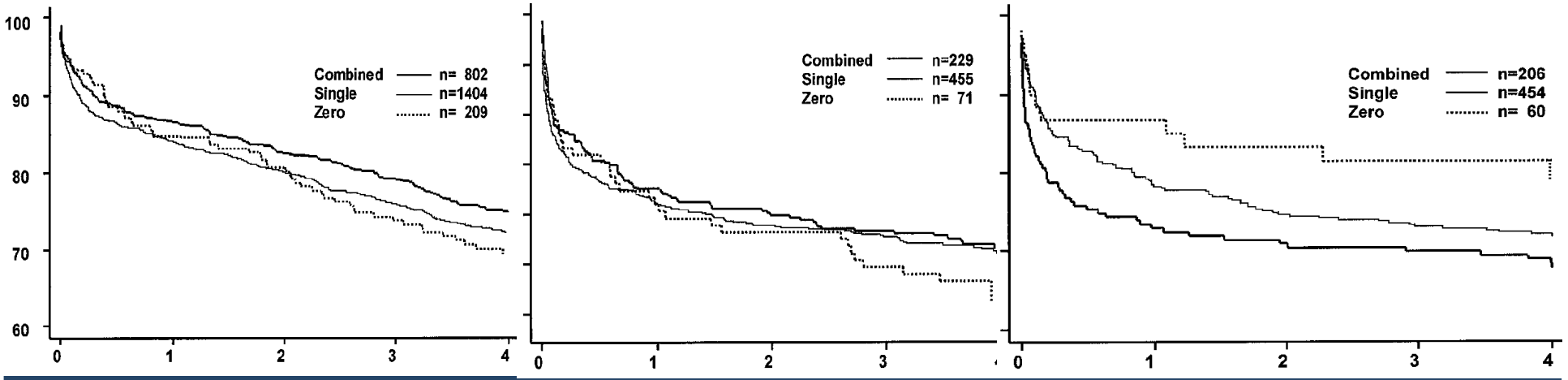
Central Venous Pressure

- Final CVP < 10 mmHG
  - 44% more hearts
  - 95% more lungs
  - 13% more kidneys
  - No negative impact on other organs

Abdelnour, J Heart Lung Transplant 2009

Katecholamines and Allograft Survival

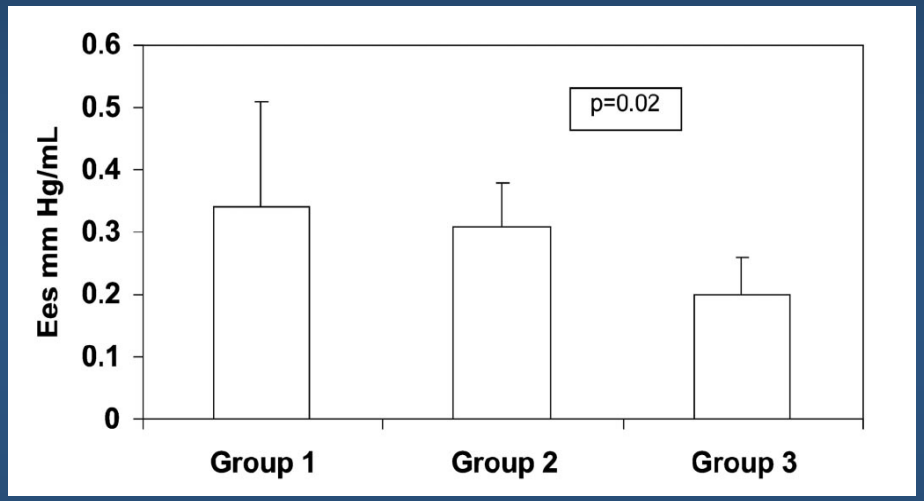
Kidney | Liver | Heart



better | indifferent | worse

Stoica, Transplantation 2004

Norepinephrine and Cardiac Function



no 0,04 0,21

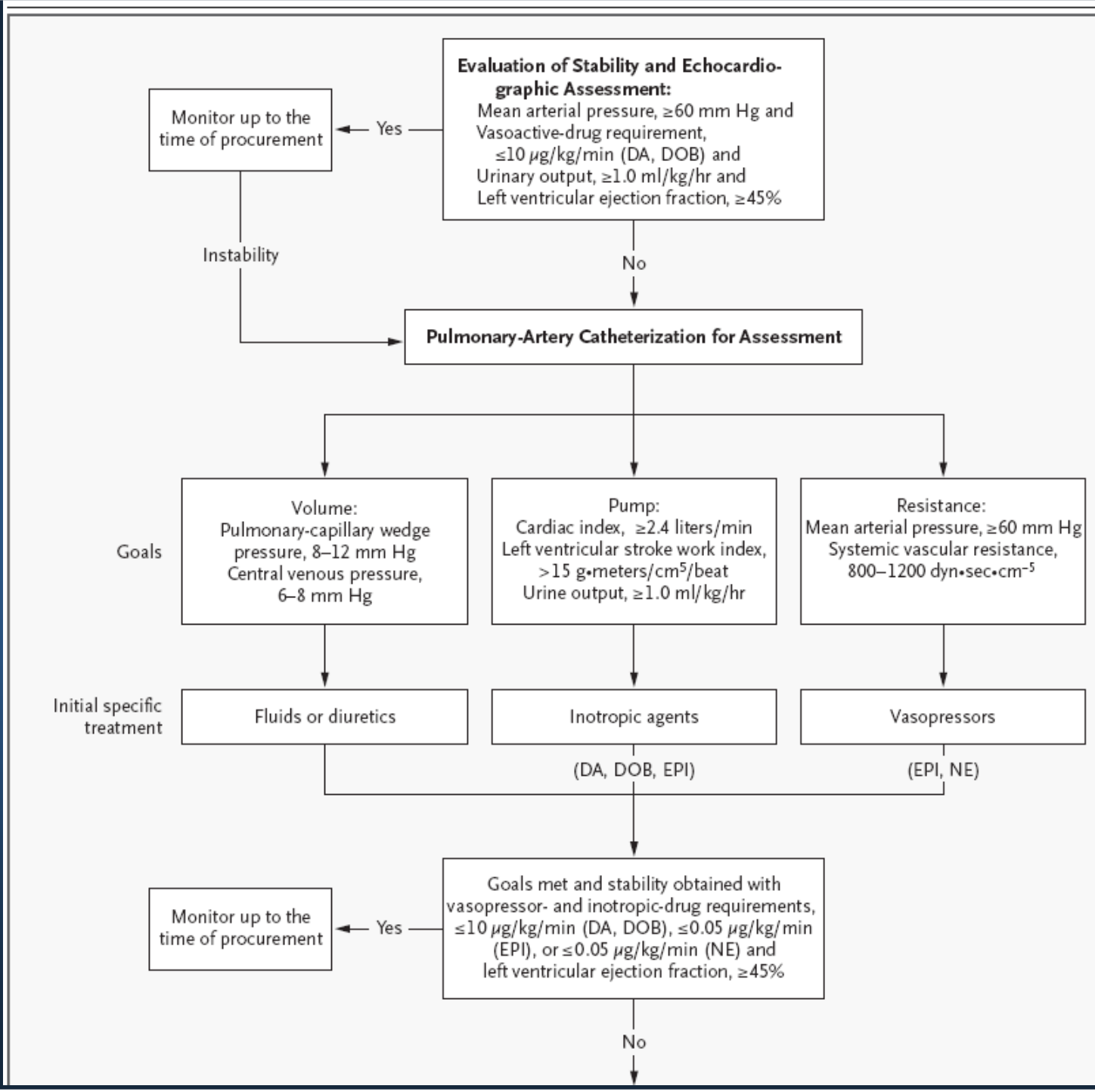
Norepinephrine mcg/kg/min

Stoica, Transplantation 2004

Glucose-Insulin-Potassium

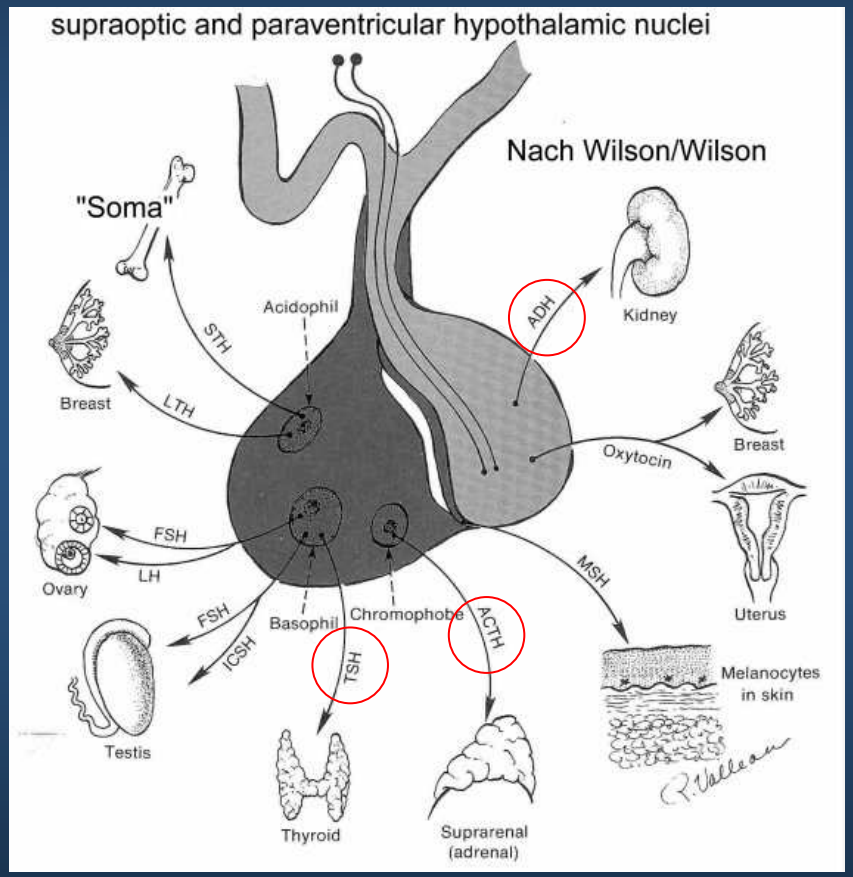
	Baseline	Dobutamine	GIK
EFa %	21-25	39	37
HR	118-121	150	116
MAP	80-89	71	79

Nicolas-Robin, CCM 2008



Wood, NEJM 2004

Hormone Depletion in Brain Death



- Vasopressin
- Insulin (resistance)
- Cortisol
- T3 and T4

Diabetes Insipidus in Brain Death

- Destruction of the posterior pituitary gland
  - Loss of free water
  - Hyperosmolarity
  - Hypernatremia
  - Volume depletion
  - Hypotension

Which Vasopressin?

Peptide	Simplified amino acid structure	Activity in relation to arginine vasopressin: Antidiuretic-effect	Activity in relation to arginine vasopressin: Vasopressor-effect	Comment
Arginine vasopressin	Cys-Tyr-Phe-Glu-Asp-Cys-Pro-**L-Arg**-Gly-(NH_2)	100	100	ADH/AVP Piressin®[a]
Lysine vasopressin	Cys-Tyr-Phe-Glu-Asp-Cys-Pro-**Lys**-Gly-(NH_2)	80	60	LVP Lypressin®[a]
Oxytocin	Cys-Tyr-**Ile**-Glu-Asp-Cys-Pro-**Leu**-Gly-(NH_2)	1	1	Induces myometrical contradictions
Ornithine vasopressin	Cys-Tyr-Phe-Glu-Asp-Cys-Pro-**Orn**-Gly-(NH_2)	22	90	POR 8®[a], esophageal varices
DDAVP	Cys-Tyr-Phe-Glu-Asp-Cys-Pro-**D-Arg**-Gly-(NH_2)	1200	0.39	Desmopressin®[a], increases Factor VIII

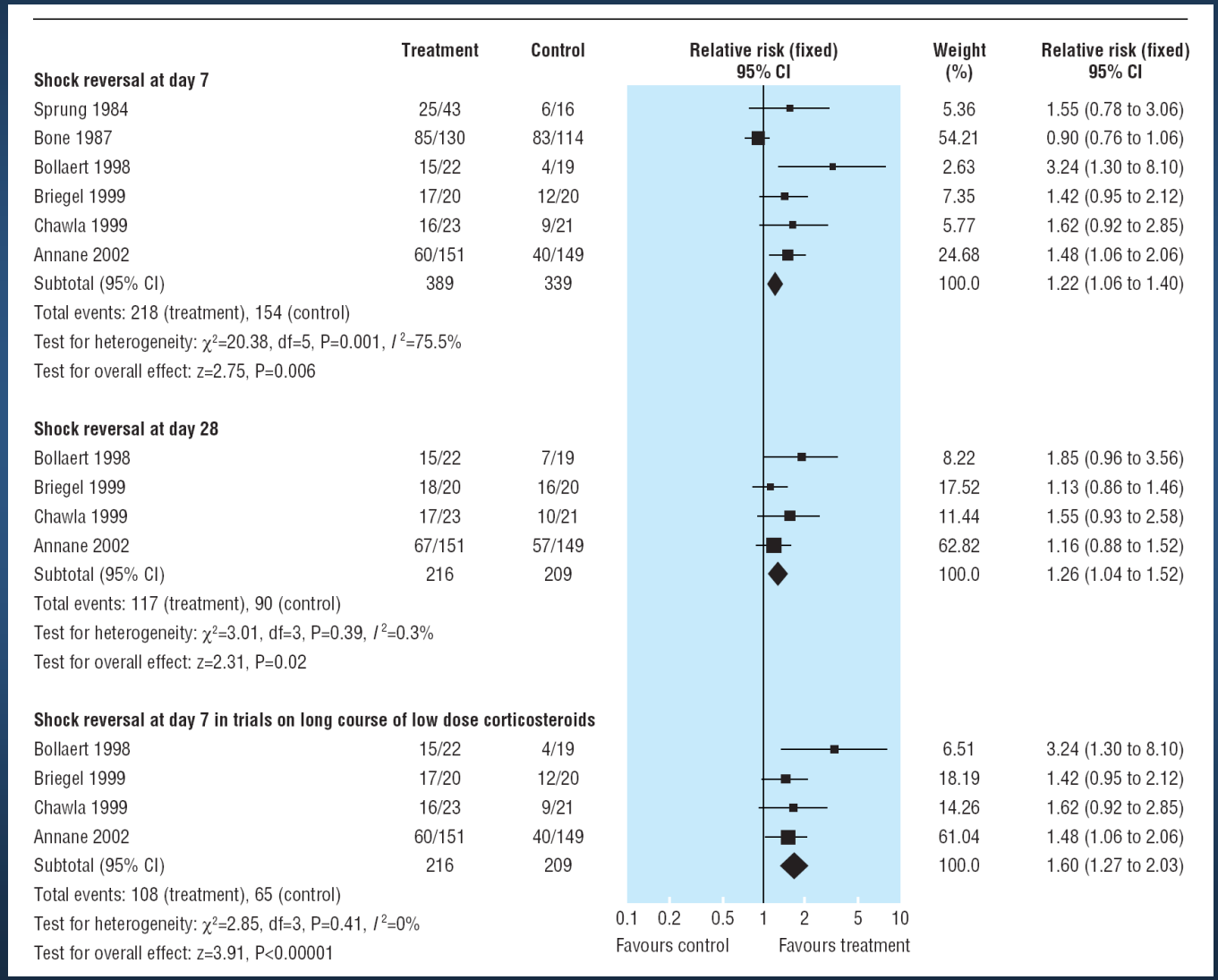
Dunser, Drugs 2003

Brain Death and Cortisol Levels

	No BD	Before BD	After BD
	Group A (n = 20)	Group B (pre-BD) (n = 10)	Group B (post-BD) (n = 17)
Baseline cortisol, μg/dL	17.0 ± 6.6	23.5 ± 11.4[a]	8.5 ± 6.2[b]
Stimulated cortisol, μg/dL	23.9 ± 5.7	28.8 ± 9.9[a]	16.9 ± 6.3[c]
Increment in cortisol, μg/dL	6.9 ± 3.6	5.3 ± 2.1[a]	8.3 ± 4.8[d]
Response to ACTH			
Normal, n	18	9[a]	4[e]
Inadequate, n	2	1	13

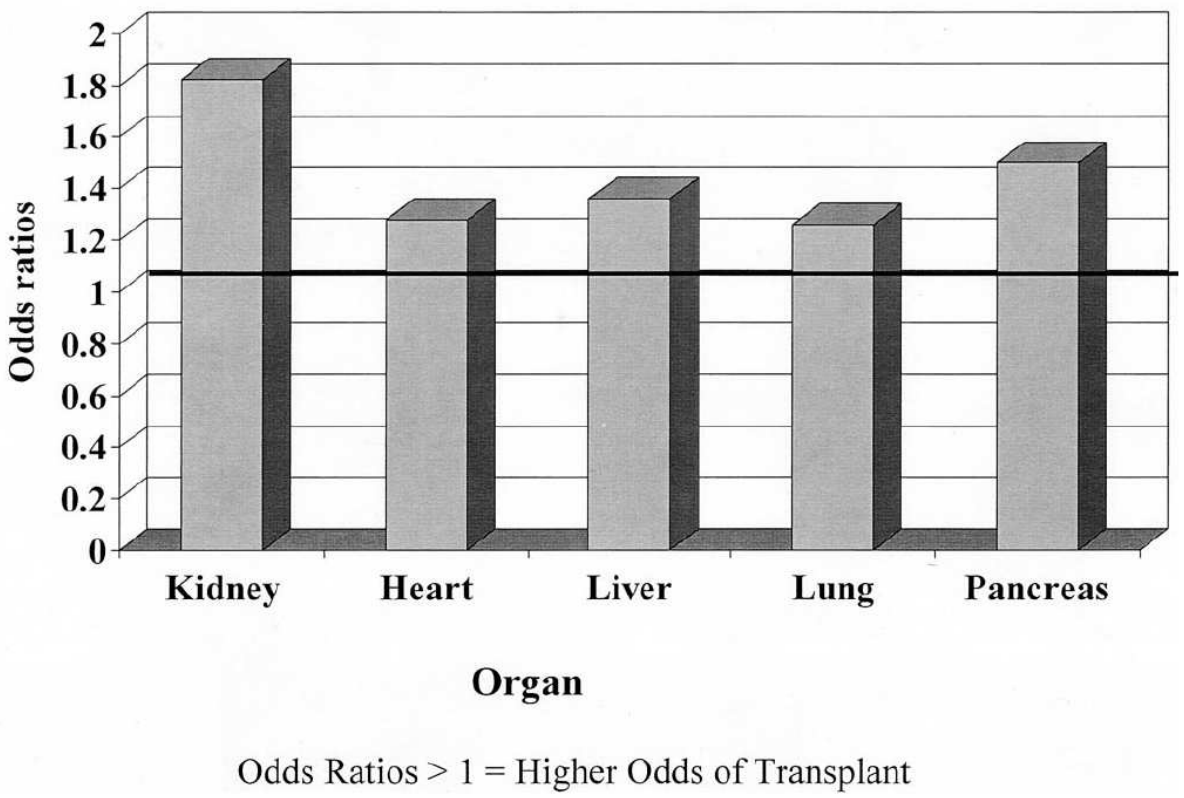
Dimopoulou, CCM 2003

Shock Reversal and Hydrocortisone (300mg/day) in Sepsis



Annane, BMJ 2004

Hormone Replacement: T3

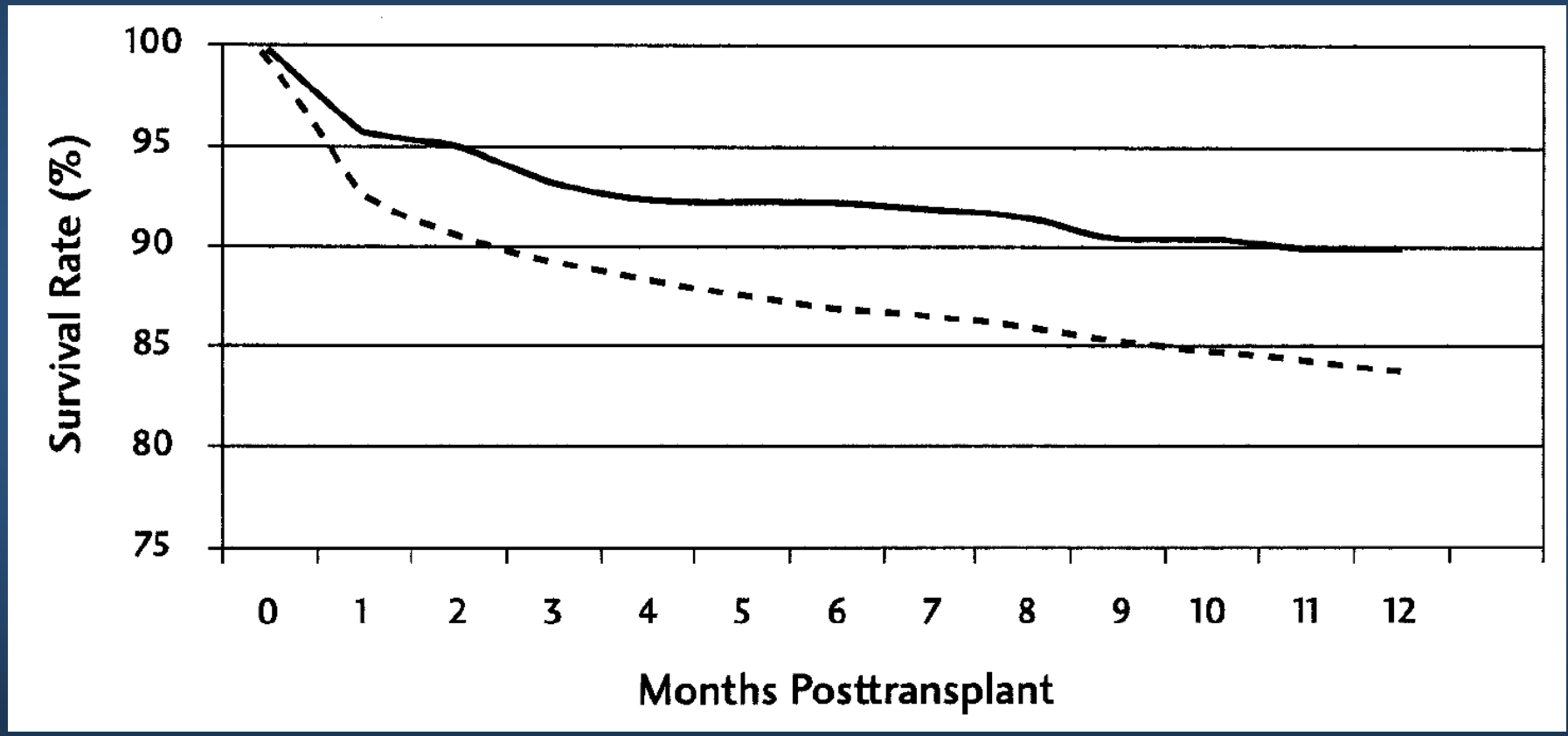


Odds Ratios > 1 = Higher Odds of Transplant

FIGURE 1. Odds of an organ being recovered and transplanted: Hormonal resuscitation (HR) versus nonhormonal resuscitation (NHR).

Rosendale, Transplantation 2003

Hormone Replacement and Heart Survival



Rosendale, Transplantation 2003

No

Hormone-Replacement Therapy

	Bolus	Infusion
Triiodothyronine	4.0 μg	3.0 μg/hr
or		
Thyroxine	20 μg	10 μg/hr
and		
Methylprednisolone	15 mg/kg	Repeat in 24 hr
Vasopressin	1 U	0.5–4.0 U/hr
Insulin	10 U (50% dextrose)	Maintain glucose between 80 mg/dl and 150 mg/dl (minimum insulin rate, 1 U/hr)

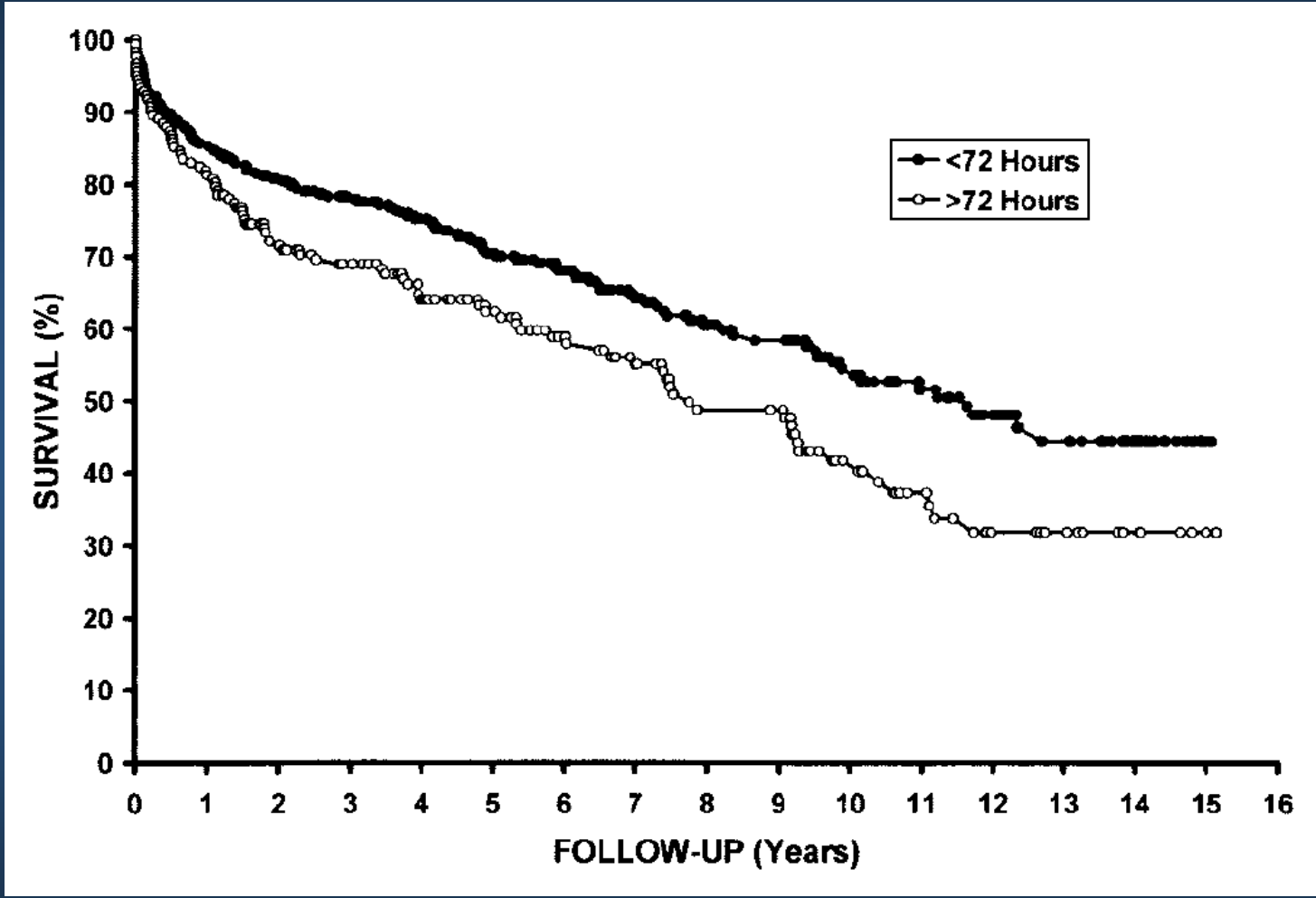
Reassess goals and stability
Identify organs appropriate for procurement

Wood, NEJM 2004

Organ Donor Management Protocol

- Increases Number of Organs procured
- Decreases Number of Donors lost
  - Rosendale, AJT 2002
  - Rosendale, Transplantation 2003
  - Salim, J Trauma 2005
  - Abdelnour, J Heart Lung Transplant 2009

Management Time and Heart Survival



Cantin, Transplantation 2003

Take Home

- Hypotension
  - Replace fluids adequately
  - Administer vasopressors carefully
  - Control Diabetes insipidus
  - Replace Hormons

Conclusion

- Install a Donor Management Protocol
- „What is good for Heart and Lung, is also good for Other Organs“
- Save Time

Thank You