AMERICAN COLLEGE OF OSTEOPATHIC INTERNISTS

Critical Care Review for Boards

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Disclosures

I have no disclosures, conflicts of interest related to this subject or talk

Lecture Objectives

- Spit out information you need to know for the boards.
- Review cardiopulmonary resuscitation (CPR).
- Review current guidelines & goals for Sepsis, Septic Shock & ARDS.
- Be able to interpret mechanical ventilation strategies for ICU patients.
- Outline key studies used to make decisions in the ICU.

Critical Care Question

A middle aged man collapses after the slot machine showed 

He is unresponsive an has no pulse or respirations. The first correct intervention is?

(A) Chest compression at 100/minute
(B) Use of AED by ACLS trained personal
(C) Provide 3 immediate shocks before CPR
(D) Establish airway and administer 12 breaths (ABC)

Executive Summary: 2015 American Heart Association Guidelines Update for Cardiopulmonary Resuscitation
November 3, 2015, Volume 132, Issue 18 suppl 2

Critical Care Question

You are asked to be on the ICU Stewardship committee for infection control and antibiotics use. Which of the following evaluations have proven to be *the most* successful in reducing ICU infections?

(A) Education
(B) Proper hand washing
(C) Daily sedation vacation
(D) Nasal decontamination with Bactroban

Critical Care Question

There has been an increase in methicillin-resistant *Staphylococcus aureus* (MRSA) infections in your intensive care unit, and you are asked to provide an action plan to address this situation.

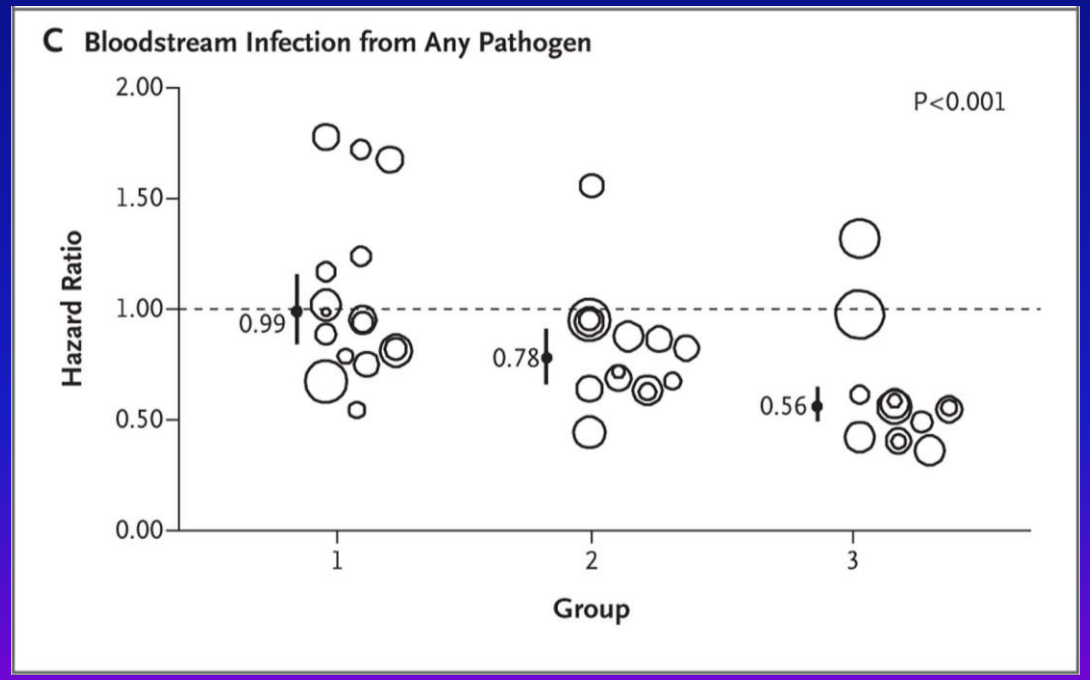
Which of the following should you recommend?

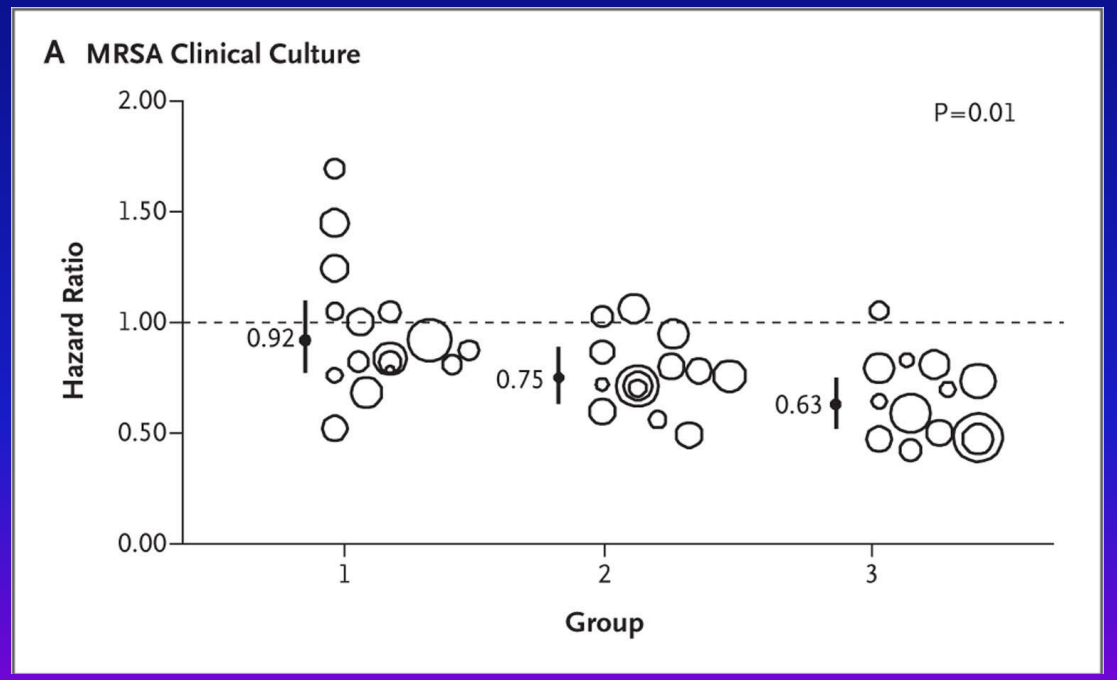
(A) Universal decolonization
(B) Gastrointestinal decolonization
(C) Targeted decolonization (nares etc.)
(D) Patient screening & contact isolation

Huang SS, Septimus E, Kleiman K, et al. Targeted versus universal decolonization to prevent ICU infection. N Engl J Med. 2013;368:2255–2265.

Universal Decolonization

- In this trial involving 74 ICUs at 43 hospitals, universal decolonization with the use of chlorhexidine and mupirocin was associated with a decrease in all-cause bloodstream infections.





N Engl J Med 2013; Volume 368(24):2255-2265

Case Presentation - Question

A 69-year-old woman is brought to the emergency department from a nursing home because of confusion, fever, & flank pain.

Temperature is 38.5 C (101°F), pulse rate is 123/minute, respirations are 27 per minute, and blood pressure is 82/48 mmHg.

Physical examination reveals dry mucous membranes, costovertebral tenderness, poor skin turgor, and no edema. Leukocyte count is 15,000 and urinalysis shows >100 wbc's with many bacteria. The patient has a anion gap metabolic acidosis with high lactate levels (6 mg/dl or 0.6 mmol/L).

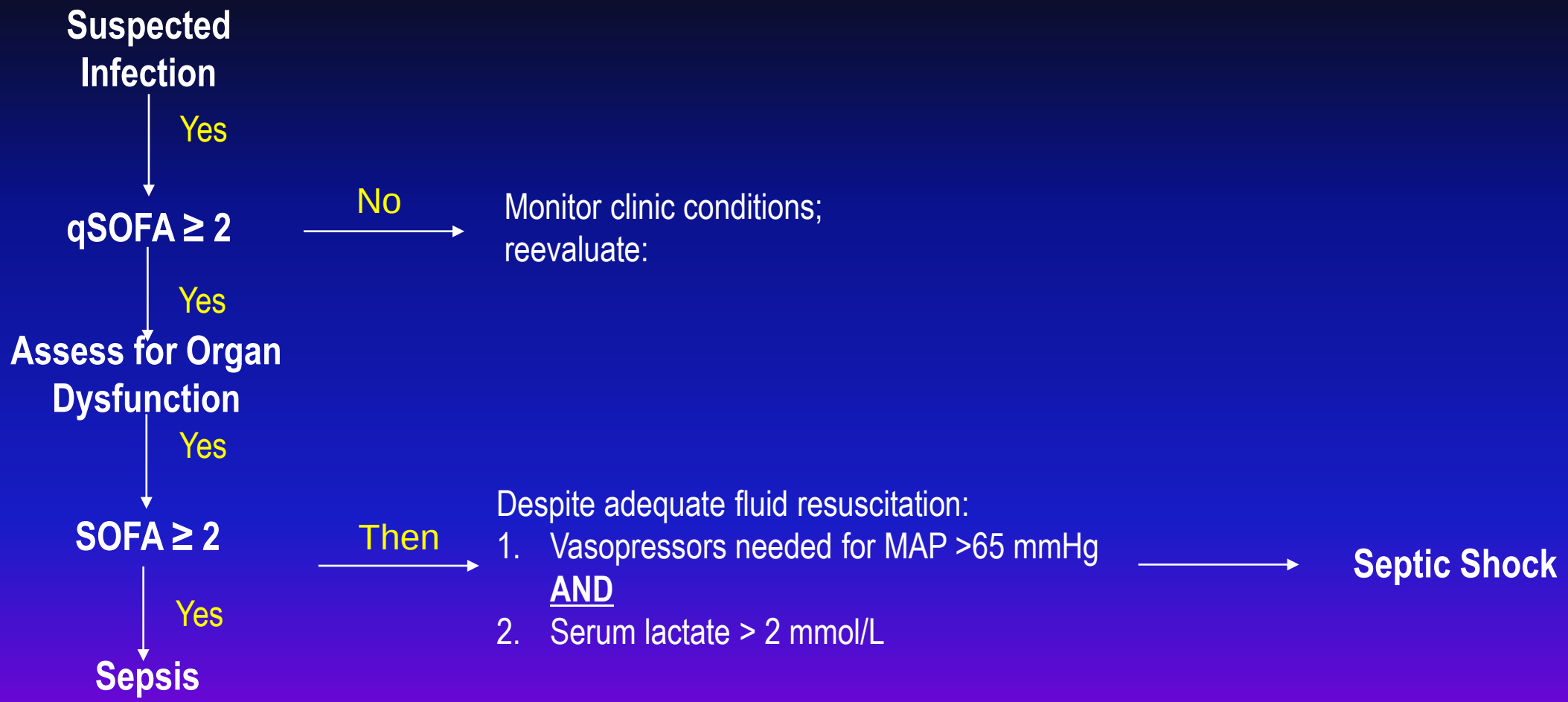
Case Presentation - Question

Base on the presentation which category is the patient currently in ?

A. This patient has SIRS (systemic inflammatory response)
B. The case describes Sepsis
C. This is clearly Severe Sepsis
D. No, this is Septic Shock

Singer M et al. The Third International Consensus Definitions for Sepsis and Septic Shock (Sepsis-3). JAMA 2016; 315(8): 801 – 810

NEW Sepsis Screening Outline



VIDEOS: http://jamanetwork.com/journals/jama/fullarticle/2492881

Assessment Score for Mortality

- qSOFA identifies highest mortality rates compared to SOFA or SIRS.

- A retrospective cohort compared the performance for the SIRS criteria, the sepsis related organ failure assessment (SOFA) score, and quick SOFA.
- Database of 30,239 adults > 45 years of age or older over 11 years.
- In- hospital mortality and one year mortality.
  - N=2,593 met SIRS, N=1,080 met SOFA criteria, N=378 met qSOFA.
  - In hospital mortality was (23%) for qSOFA, (13%) SOFA & SIRS (9%).
  - Same was true for 1 year mortality

Donnelly JP et al. Application of the Third International Consensus Definition for Sepsis Classification: A Retrospective Population based cohort Study. Lancet Infect Dis. 2017
Third International Consensus Definitions for Sepsis and Septic Shock (Sepsis-3) JAMA, 2016

Definition of Systemic Inflammation

Increase mortality

	Old Criteria	New Criteria
Sepsis	Infection + SIRS	Infection + qSOFA >2 Or Rise in SOFA >2
Severe Sepsis	Sepsis + Hypotension, hypoxemia, elevated lactate or other endo organ signs/findings	Bye, Bye, Bye
Septic Shock	Sepsis + Hypotension after adequate fluid resuscitation	Sepsis + Vasopressors + lactate > 2

Cawcutt, KA & Peters, SG. Mayo Clin Proc. 2014; 89 (11);1572 - 1578
Third International Consensus Definitions for Sepsis and Septic Shock (Sepsis-3) JAMA, 2016

SOFA / qSOFA

Organ System	Measurement	SOFA SCORE				
		0	1	2	3	4
Respiration	PaO_2/FiO_2	Normal	<400	<300	<200	<100
Coagulation	Platelets	Normal	<150	<100	<50	<20
Liver	Bilirubin, mg/dL	Normal	1.2 -1.9	2.0 5.9	6.0 – 11.9	>12
Cardiovascular	Hypotension	Normal	MAP <70 mmHg	Any pressor	Dose > 5 Dop NE <0.1 mcg/kg/min	Dose Dop >15 NE >0.1
CNS	GCS	Normal	13 – 14	10-12	6-9	<6
Renal	Cr mg/dL Urine output	Normal	1.2 -1.9	2.0 - 3.4	3.5 - 4.9 <500 ml/d	>5.0 >200ml/d

Cawcutt, KA & Peters, SG. Mayo Clin Proc. 2014; 89 (11);1572 - 1578
Third International Consensus Definitions for Sepsis and Septic Shock (Sepsis-3) JAMA, 2016

Return to the Case Presentation

A 69 year-old woman is brought to the emergency department from a nursing home because of confusion, fever, & flank pain.

Temperature is 38.5 C (101.3°F), pulse rate is 123/minute, respirations are 27 per minute, and blood pressure is 82/48 mmHg.

Physical examination reveals dry mucous membranes, costovertebral tenderness, poor skin turgor, and no edema. Leukocyte count is 15,000 and urinalysis shows >100 wbc's with many bacteria. The patient has a anion gap metabolic acidosis with high lactate levels (6 mg/dl or 0.6 mmol/L).

Case Presentation - Question

In conjunction with appropriate antibiotics, which of the following choices is most likely to result in *improved survival* for this patient (Best Answer)?

A. Placement of a central venous catheter

B. Aggressive & early fluid resuscitation with crystalloid

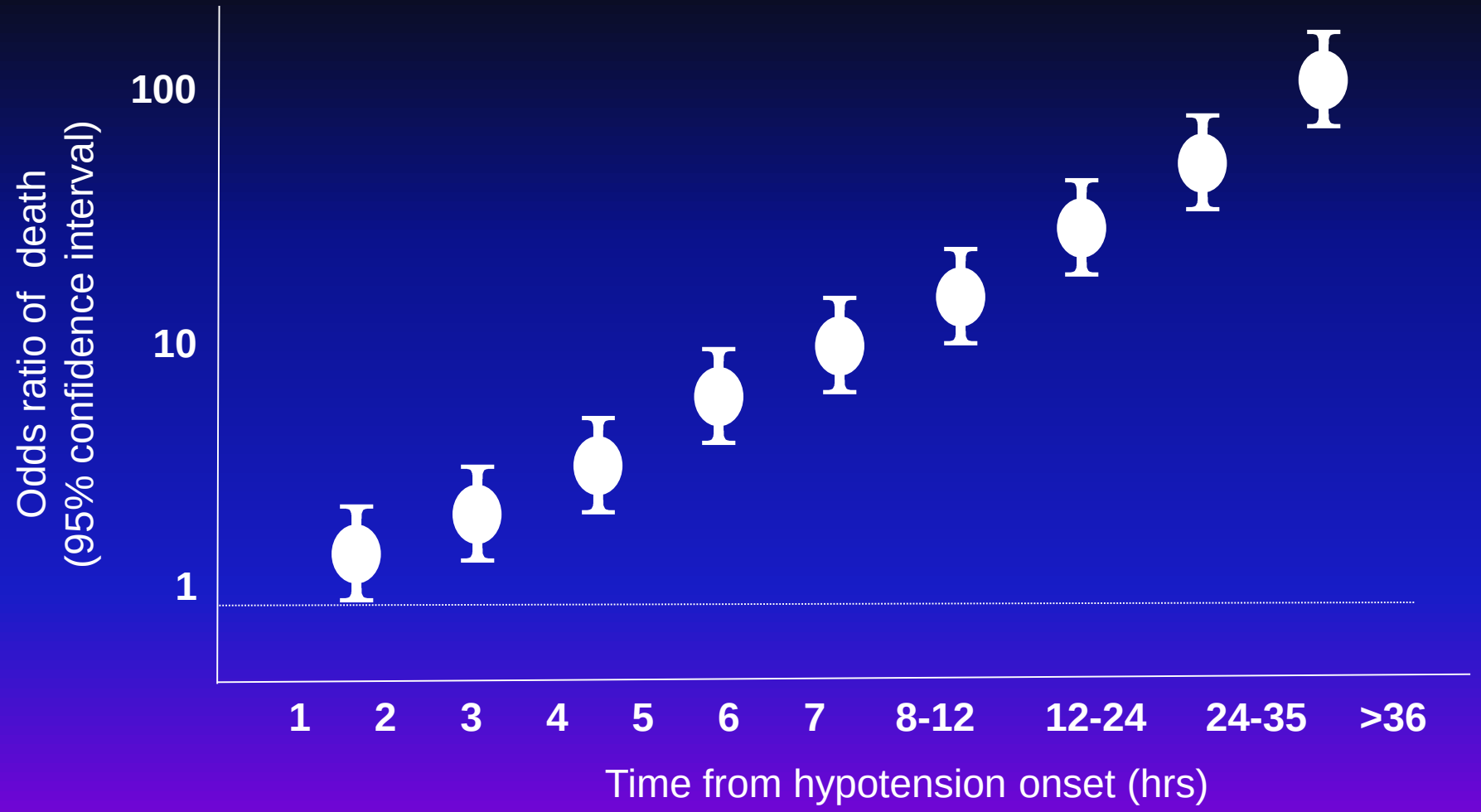
C. Maintaining a hemoglobin level above 10 mg/dl

D. Maintaining a $PaCO_2$ below 50 mmHg

E. Administration of systemic steroids

Emanuel Rivers, et al. The Early Goal-Directed Therapy Collaborative Group. N Engl. J Med 2001; 345:1368-1377
Sepsis & Septic Shock. Mayo Clin Proc. 2014;89(11):1572-1578

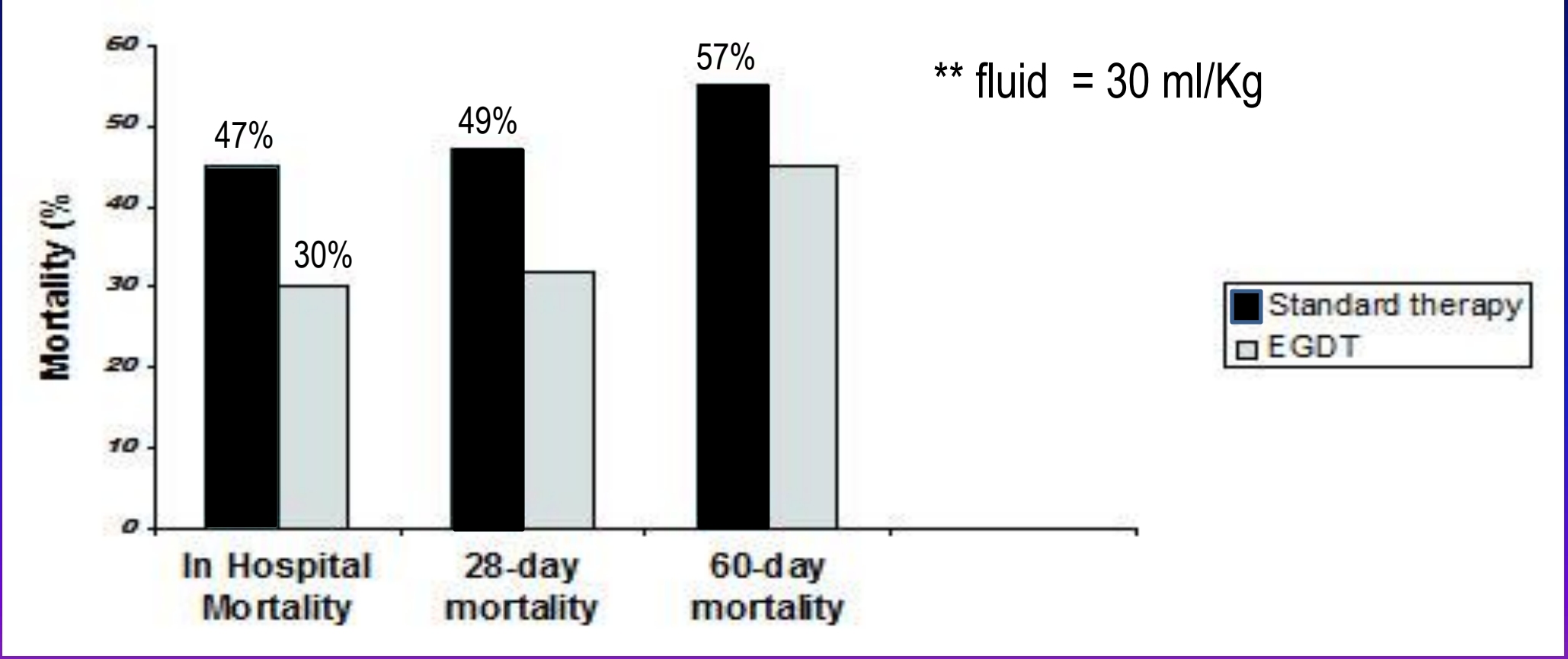
The Effects of Antibiotics On Survival



Kumar et al. Crit Care Med. 2006 Jun;34(6):1589-96.
Duration of hypotension before initiation of effective antimicrobial therapy is the critical determinant of survival in human septic shock.

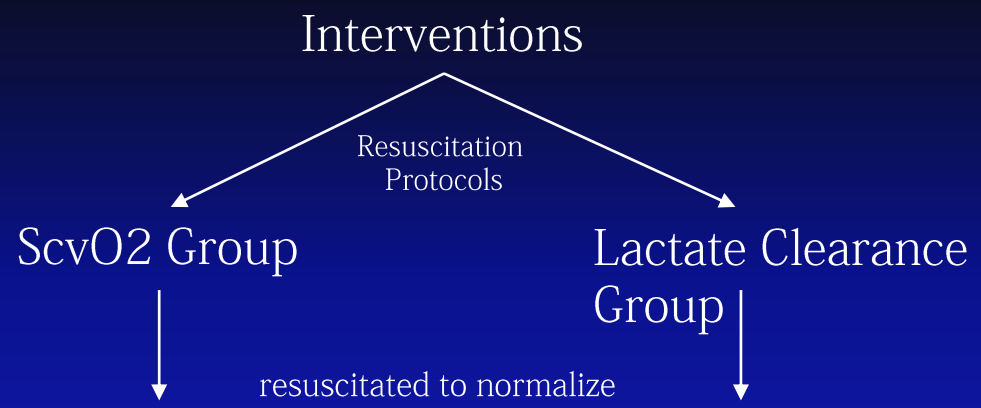
Case Presentation - Answer
Goal Directed Therapy

To emphasize that aggressive fluid resuscitation is a life saving & time sensitive intervention for sepsis patients, regardless of the type of monitoring device.



Emanuel Rivers, et al. the Early Goal-Directed Therapy Collaborative Group. N Engl. J Med 2001; 345:1368-1377

Case Presentation
Parameter Directed Therapy



Equivalence ≠ in:

Mortality	17 % v. 23 % (EGDT)
Hospital LOS	11 % v. 12 % (EGDT)
MSOF	25 % v. 22 % (EGDT)

Study protocol was continued until all goals or for up to 6 hours.

Intervention, h	No. (%) of Patients: Lactate Clearance Group (n = 150)	No. (%) of Patients: $ScvO_2$ Group (n = 150)	*P* Value[a]
Crystalloid volume, mean (SD), L			
0-<6	4.5 (2.36)	4.3 (2.21)	.55
6-72	12.4 (6.15)	11.8 (6.41)	.44
Vasopressor administration			
0-<6	108 (72)	113 (75)	.60
6-72	100 (67)	108 (72)	.45
Dobutamine administration			
0-<6	5 (3)	8 (5)	.57
6-72	10 (7)	13 (9)	.66
PRBC transfusion			
0-<6	11 (7)	5 (3)	.20
6-72	35 (23)	31 (21)	.78
Mechanical ventilation			
0-<6	40 (27)	39 (26)	.99
6-72	69 (46)	75 (50)	.56
Activated protein C			
0-<6	0	0	
6-72	3 (2)	2 (1)	.68
Parenteral corticosteroids			
0-<6	18 (12)	26 (17)	.25
6-72	59 (39)	51 (34)	.40

Jones A et al. JAMA. 2010;303(8):739-746. doi:10.1001/jama.2010.158.

Case Presentation - Question

As it relates to our patient, which of the following statements regarding sepsis fluid management treatment is correct in improving mortality?

A. Placement of a central venous catheter

B. Monitoring SvO2 (mixed venous)

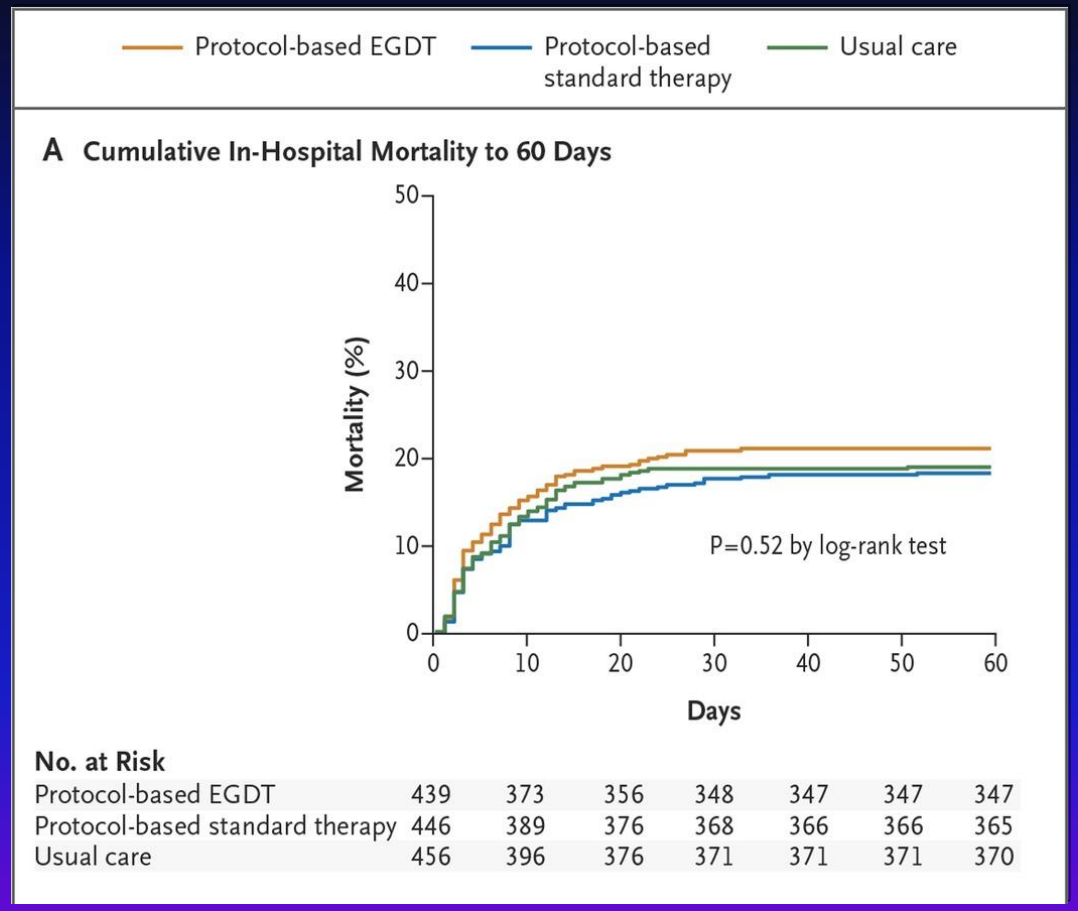
C. Aggressive fluid resuscitation 30cc/kg

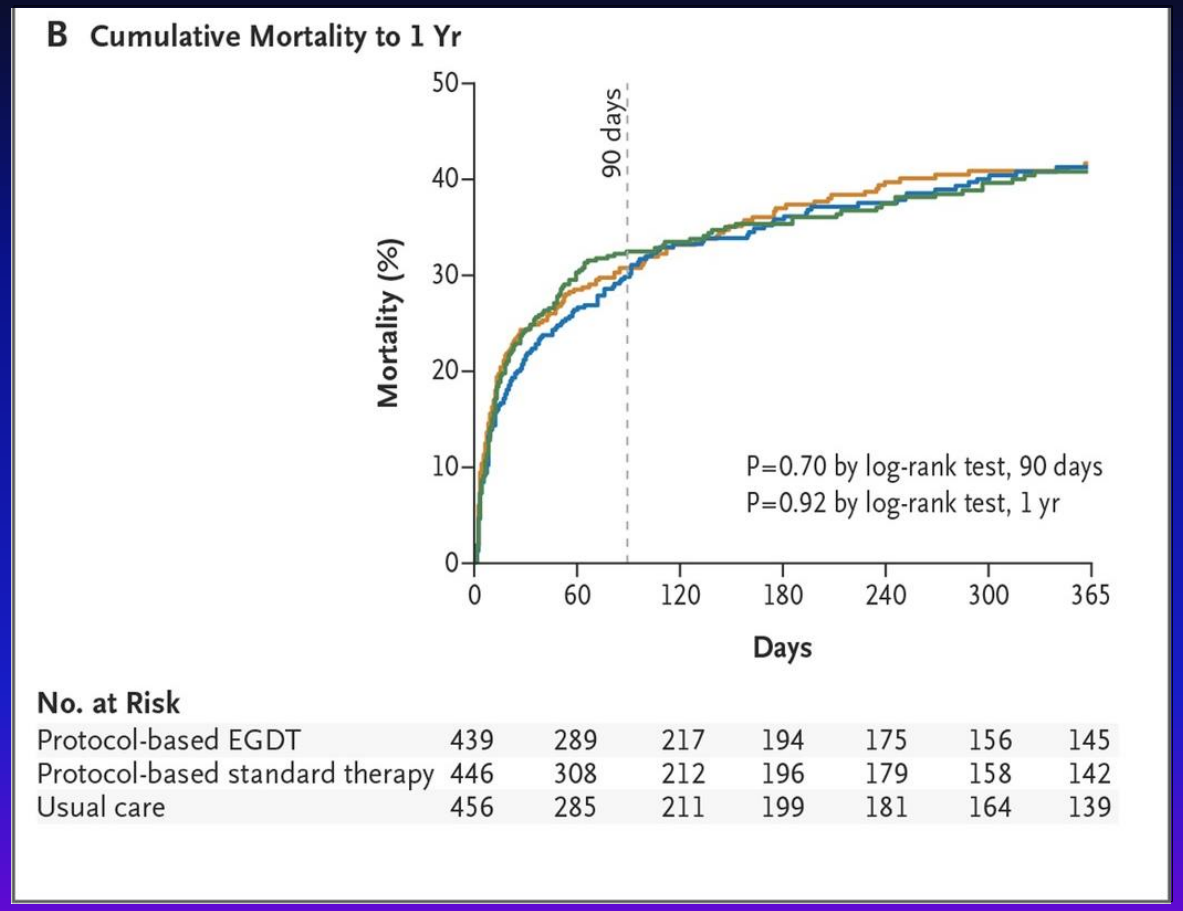
D. Colloid contain IVF at 30 cc/kg

E. Administration of albumin solution

Emanuel Rivers, et al. The Early Goal-Directed Therapy Collaborative Group. N Engl. J Med 2001; 345:1368 -1377
Annane D, Siami S, Jaber S et al. CRISTAL study.JAMA 2013 Nov 6: 310 (17):1809 – 17
Perner A et al. 6S Study. N Engl J Med 2012; 367 (2) :124 – 34.

The ProCESS Investigators
Protocolized Care for Early Septic Shock Trial





All 3 arms of the study mortality was < 21%

The ProCESS Investigators. N Engl. J Med 2014;370:1683-1693

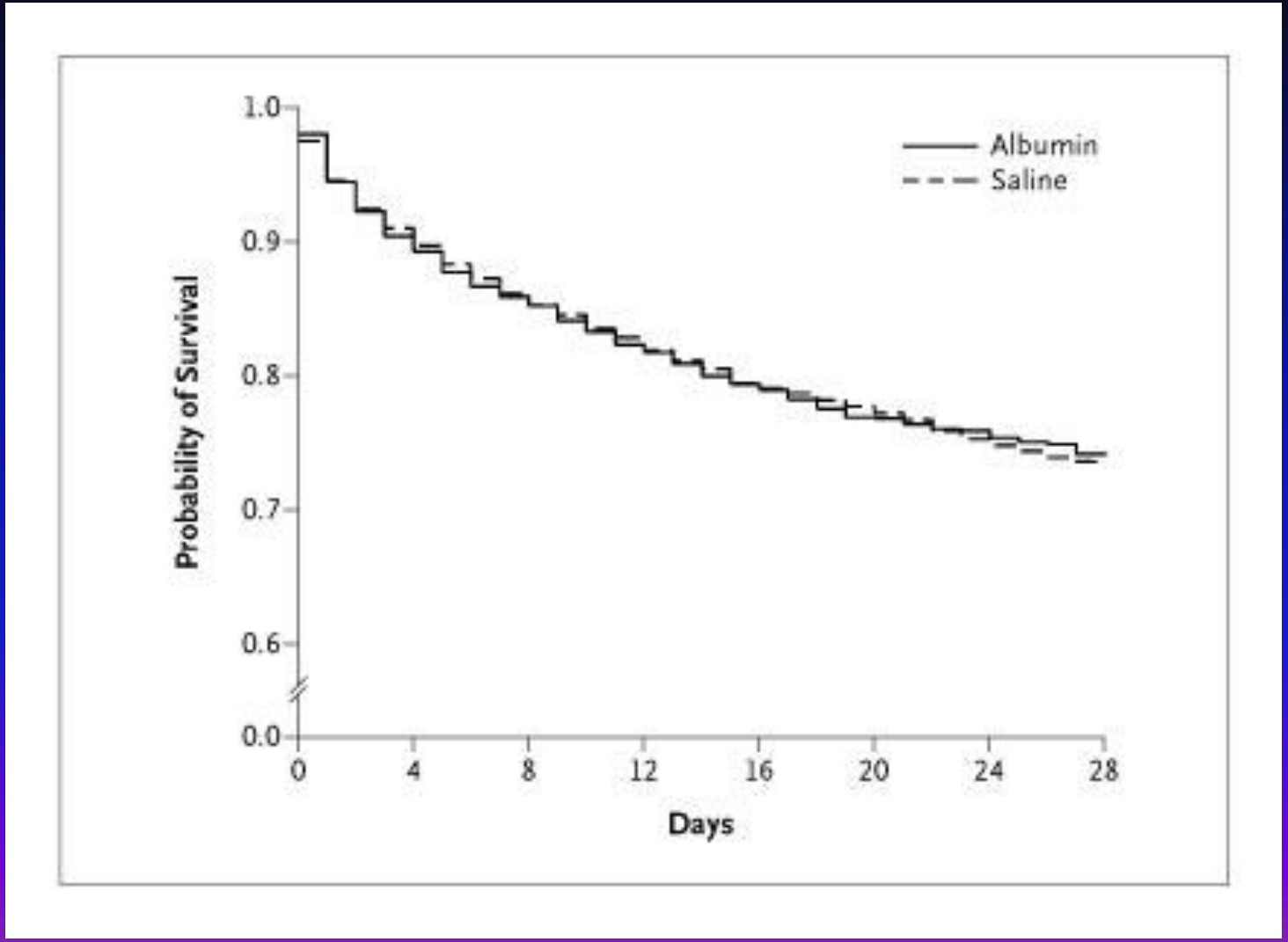
Trial Name	ProCESS	ARISE	ProMISe
Title	A Randomized Trial of Protocol-Based Care for Early Septic Shock	Goal-Directed Resuscitation for Patients with Early Septic Shock	Protocolised Management in Sepsis (ProMISe)
Location	U.S. 31 Emergency Departments	Australia/New Zealand 51 Emergency Departments	U.K. Multi-Center
Population	1935 adult subjects with septic shock (refractory hypotension or LA ≥ 4mmol/L)	1600 adult sepsis subjects with septic shock (refractory hypotension or LA ≥ 4mmol/L)	1260 adult sepsis subjects with septic shock (refractory hypotension or LA ≥ 4mmol/L)
Intervention	EGDT	EGDT	EGDT
Control	Protocol-Based Care (no CVC) Usual Care	Usual Care	Usual Care
Primary Outcome	60 Day Mortality	90 Day Mortality	90 Day Mortality
Primary Outcome Result (relative risk)	**EGDT 21% Protocol Based 18.1% Usual Care 18.9%**	**EGDT 18.6% Usual Care 18.8%**	**EGDT 30% Usual Care 29%**
Publication Date	May 2014	October 2014	Mar 2014
Journal	NEJM	NEJM	NEJM

Adapted from:

Yealy DM et al. A Randomized Trial of Protocol-Based Care for Early Septic Shock. N Engl J Med 2014; 370:1683-1693.
Peake SL et al. Goal-Directed Resuscitation for Patients with Early Septic Shock. N Engl J Med 2014; 371:1496-1506.
Power GS et al., The Protocolised Management in Sepsis (ProMISe) trial statistical analysis plan. Crit Care Med; 2013 Dec;15(4):311-7.

A Comparison of Albumin and Saline for Fluid Resuscitation in the Intensive Care Unit

- In this trial of critically ill patients in the intensive care unit, the use of albumin (4%) and saline resulted in similar outcomes at 28 days
- Two treatments = equivalent with respect to clinical outcomes.

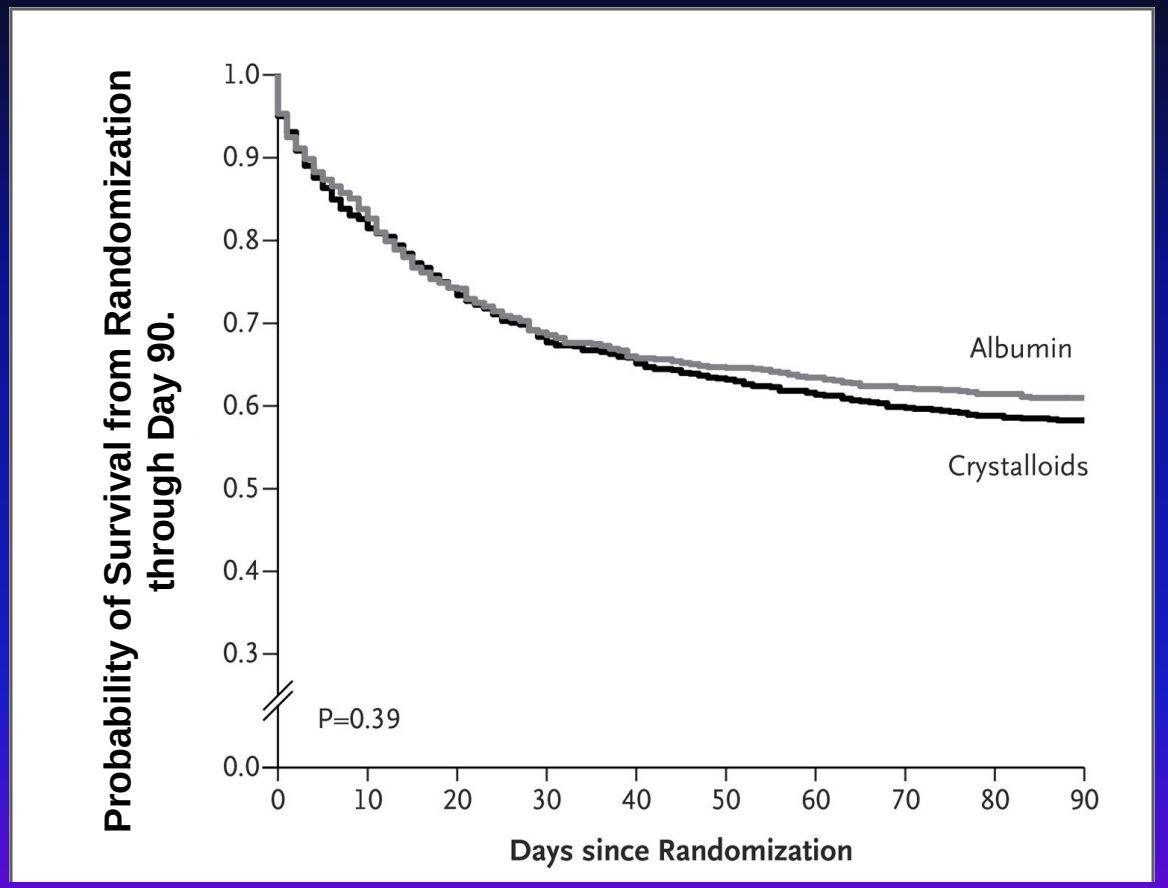


The SAFE Study Investigators, . N Engl. J Med 2004;350:2247-2256

Albumin Replacement in Patients with Severe Sepsis or Septic Shock (ALBIOS Study)

In this multicenter, open-label trial, we randomly assigned 1818 patients with severe sepsis, in 100 intensive care units (ICUs), to receive either **20% albumin and crystalloid solution** or crystalloid solution alone.

RESULT: In the albumin group, the target serum albumin concentration was 30 g per liter or more until discharge from the ICU or 28 days after randomization. The primary outcome was death from any cause at 28 days. Secondary outcomes were death from any cause at 90 days, the number of patients with organ dysfunction and the degree of dysfunction, and length of stay in the ICU and the hospital.



In patients with severe sepsis, albumin replacement in addition to crystalloids, as compared with crystalloids alone, did not improve the rate of survival at 28 and 90 days.

Pietro Caironi P et al. N Engl J Med 2014; Volume 370(15):1412-1421

Case Presentation - Continued

I know your ER does this too

Despite your intentions, this same 69-year-old woman receives only 2 liters of fluid over 6 hours in the ED while awaiting ICU transfer.

In the ICU, resuscitation is “ramped up” considerably with 8 liters of normal saline, but the patient develops ARDS & oliguric renal failure by the next morning. She remains hypotensive.

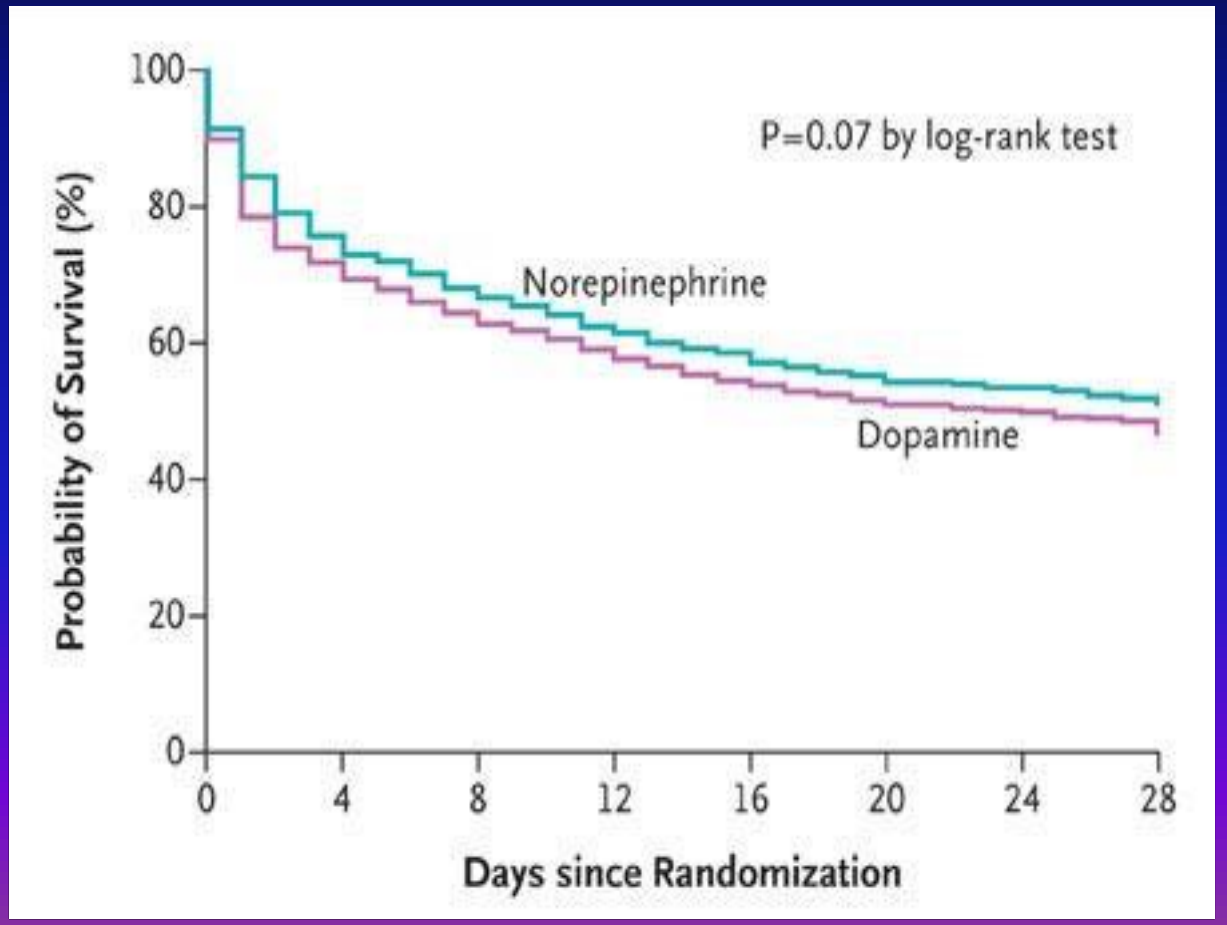
Case Presentation - Question

In this patient, the next best step includes which of the following?

(A) Start Dopamine gtt for MAP > 60 mmHg
(B) Administer high dose Vasopressin
(C) Start Rosuvastatin (lipid) medication (anti-inflammatory)
(D) Transfuse PRBC for Hb > 10 gm/dL
(E) Start Levophed gtt for MAP > 65 mmHg

Comparison of Dopamine & Norepinephrine in the Treatment of Shock

- Conclusions: No significant difference in the rate of death between patients with shock who were treated with dopamine vs. norepinephrine,
- Dopamine showed > # of adverse events.



SOAP II Study. De Backer D et al. N Engl. J Med 2010; 362:779-789

Vasopressin vs. Norepinephrine Infusion in Patients with Septic Shock

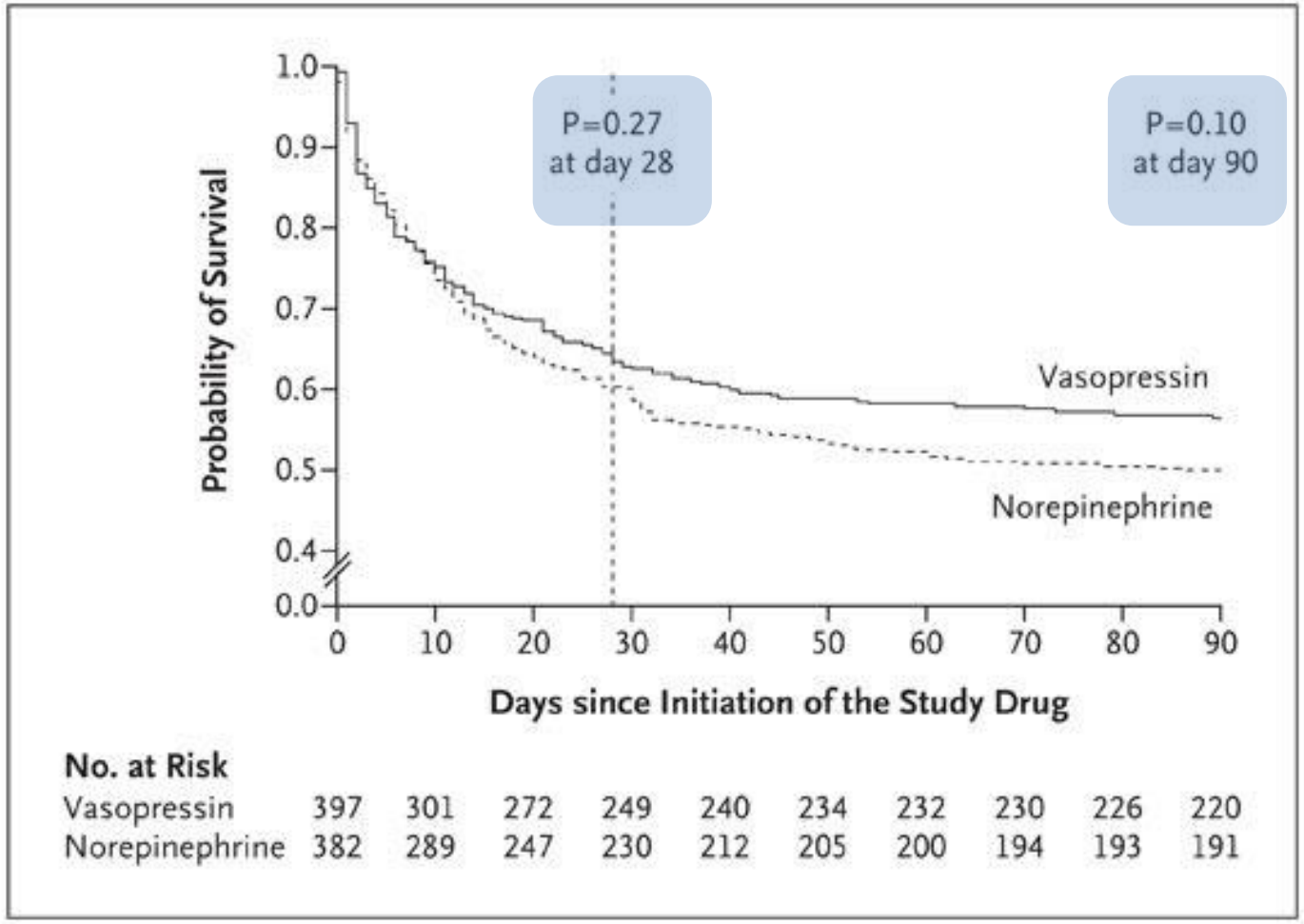


Table 3. Serious Adverse Events in Patients Who Had Septic Shock.

Variable	Norepinephrine Group (N=382)	Vasopressin Group (N=396)	P Value*
	no. (%)		
At least one serious adverse event	40 (10.5)	41 (10.3)	1.00
Acute myocardial infarction or ischemia	7 (1.8)	8 (2.0)	1.00
Cardiac arrest	8 (2.1)	3 (0.8)	0.14
Life-threatening arrhythmia	6 (1.6)	8 (2.0)	0.79
Acute mesenteric ischemia	13 (3.4)	9 (2.3)	0.39
Hyponatremia†	1 (0.3)	1 (0.3)	1.00
Digital ischemia	2 (0.5)	8 (2.0)	0.11
Cerebrovascular accident	1 (0.3)	1 (0.3)	1.00
Other‡	2 (0.5)	5 (1.3)	0.45

* Two-sided P values are based on Fisher's exact test.
† Hyponatremia was defined as a serum sodium level of less than 130 mmol per liter.
‡ Other events include acute hepatitis, agranulocytosis, pulmonary embolism, seizures, drug error, and two cases of drug extravasation from the central venous catheter.

Russell JA et al. N Engl. J Med 2008;358:877-887

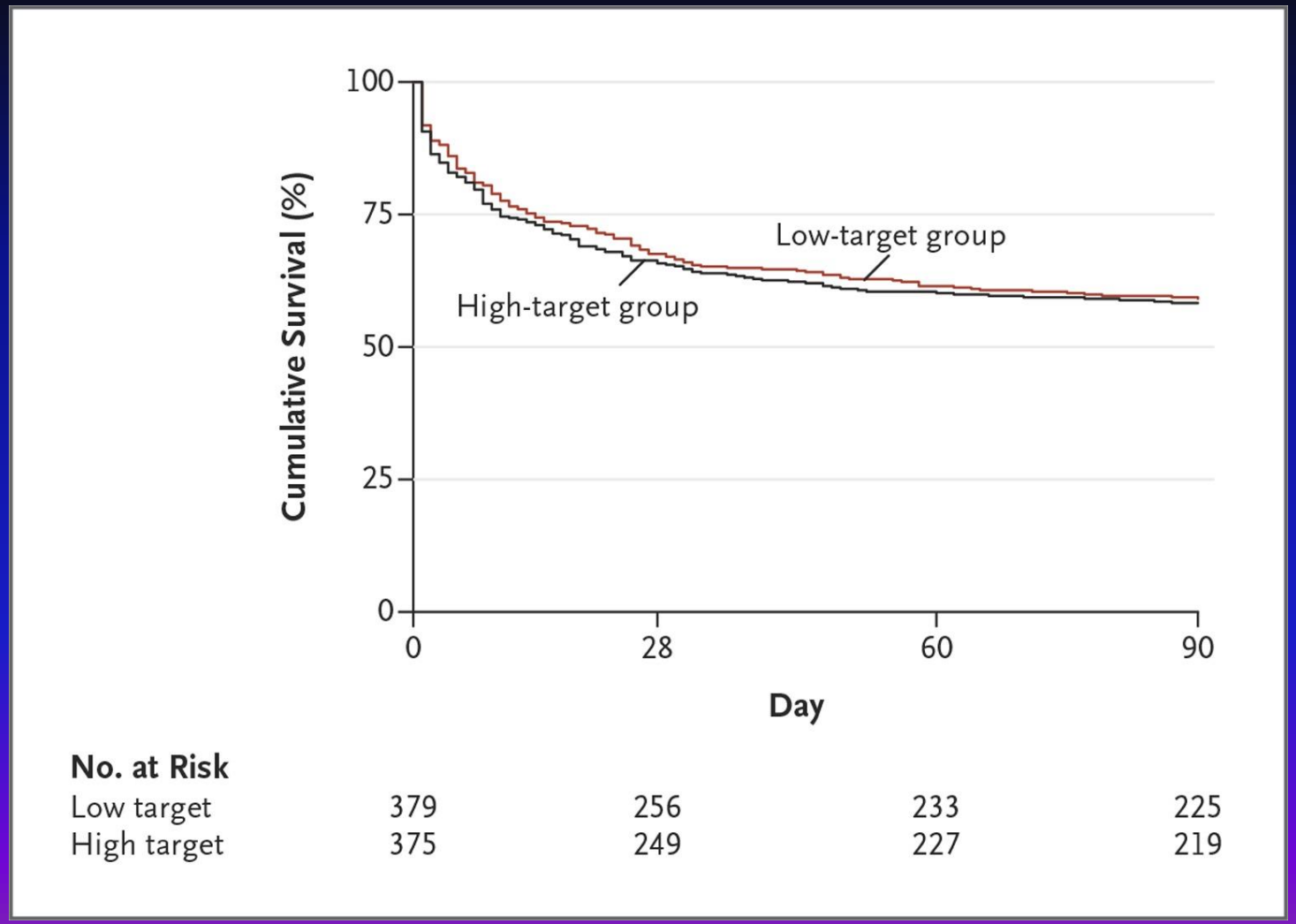
Updated Recommendations: Vasopressors (2016)

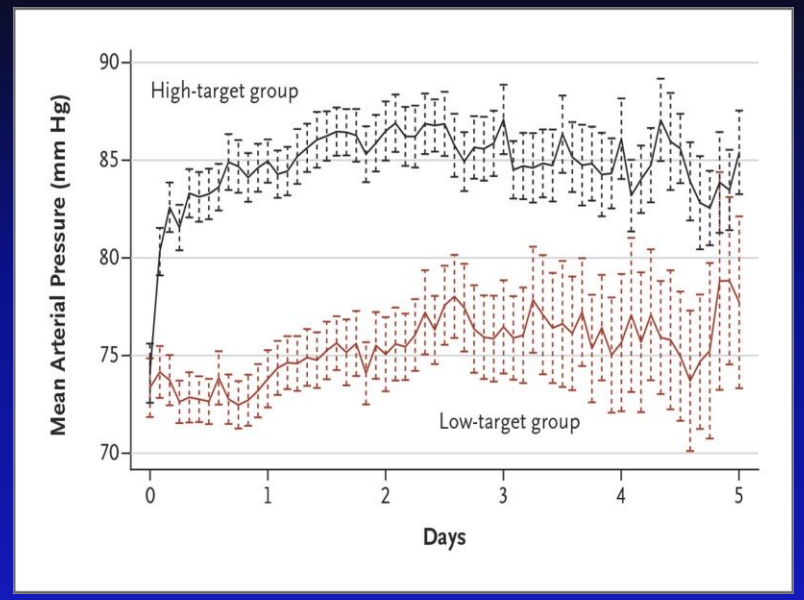
- **Norepinephrine** as the first choice (strongest recommendation)
- Suggest adding EITHER to raise the MAP
  - **Vasopressin** (0.03 units/min) - Never monotherapy
  - **Epinephrine**

- Vasopressin may be added with the intent to decrease norepinephrine dosage.
- Dopamine as an alternative vasopressor agent to norepinephrine only in selected patients (low risk to tachyarrhythmia's or absolute /relative bradycardia).
- Recommend against low dose dopamine for renal protection.
- Phenylephrine was removed from the guidelines.

Rhodes A, Evans LE, Alhazzani E et al. Crit Care Med. 2017 Epub ahead of print

High versus Low Blood-Pressure (MAP >65) Target in Patients with Septic Shock





Targeting a mean arterial pressure of 80 to 85 mm Hg, as compared with 65 to 70 mm Hg.

However, the incidence of newly diagnosed atrial fibrillation was higher in the high-target group than in the low-target group. Among patients with chronic hypertension, those in the high-target group required less renal-replacement therapy than did those in the low-target group, but such therapy was not associated with a difference in mortality.

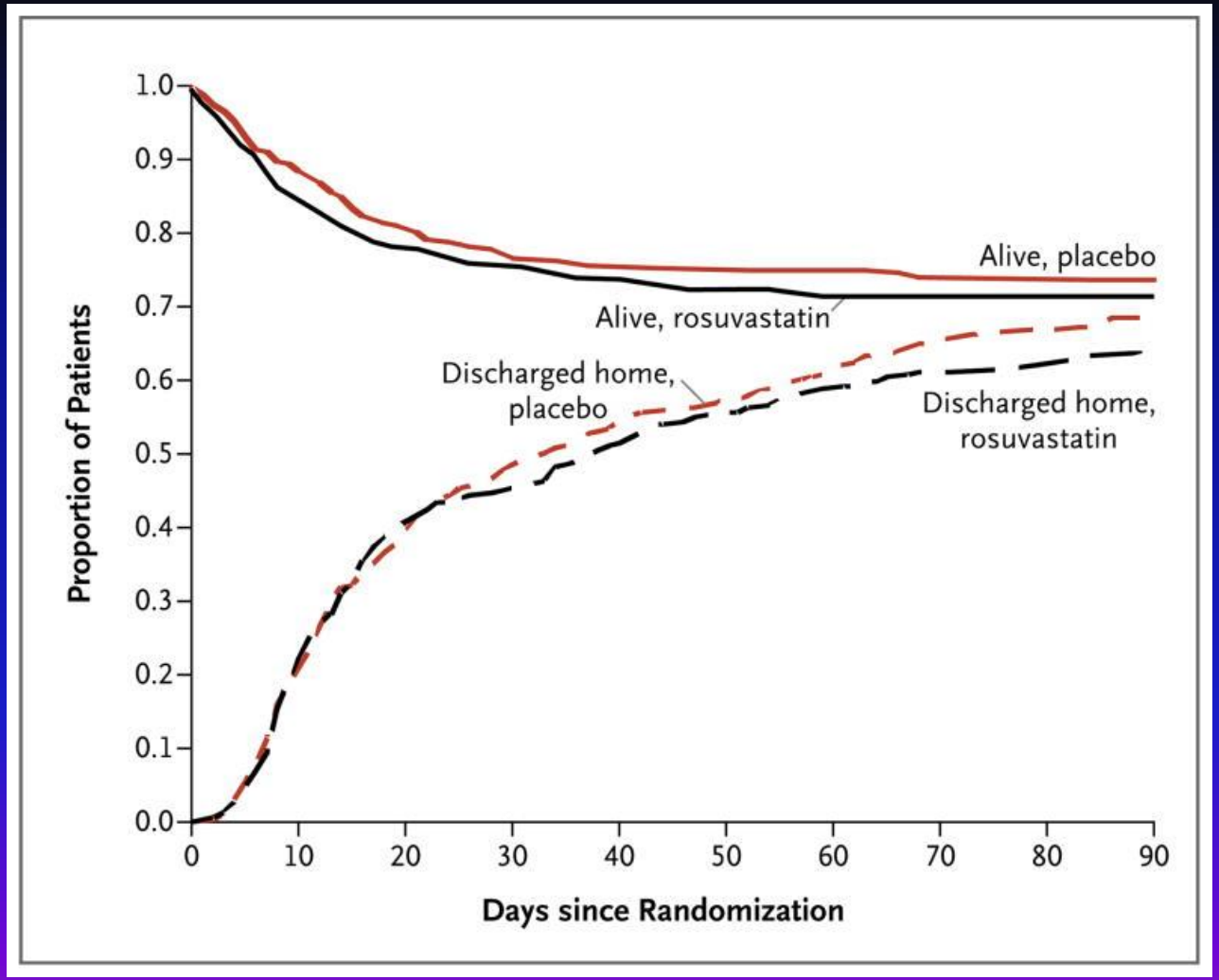
SEPSISPAM Study. Asfar P et al. N Engl. J Med 2014;370:1583-1593

Lipid (anti-inflammatory) Medication in ARDS

Multicenter trial in which patients with sepsis-associated ARDS were randomly assigned to receive either enteral rosuvastatin or placebo in a double-blind manner.

The primary outcome was mortality before hospital discharge home or until study day 60

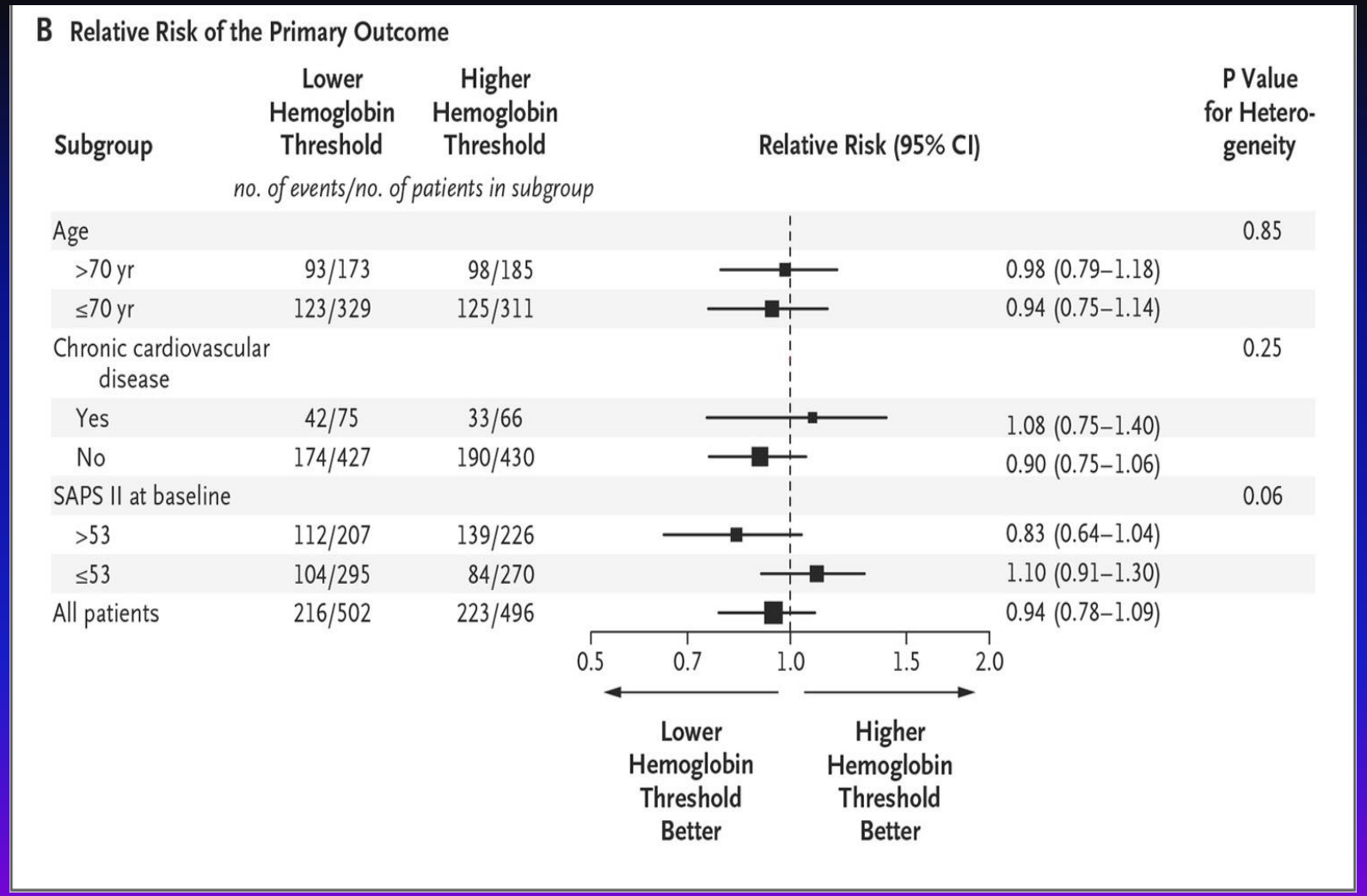
Secondary outcomes included the number of ventilator-free days (days that patients were alive and breathing spontaneously) to day 28 and organ-failure–free days to day 14



Rosuvastatin for Sepsis-Associated Acute Respiratory Distress Syndrome. NEJM 2014 370 (23) 2191 – 2200.

Transfusion Requirements in Septic Shock (TRISS)

- 1,005 patients with septic shock with Hb 9 g/dL or less
- Randomized to low (7 g/dl) or high(9g/dL)) transfusion threshold for length of ICU stay.
- In patients with septic shock, mortality at 90 days and rates of ischemic events and use of life support were similar among those assigned to blood transfusion at a higher hemoglobin threshold and those assigned to blood transfusion at a lower threshold.



TRISS Study. Holst LB et al. N Engl J Med 2014;371:1381-1391

Case Presentation - Question

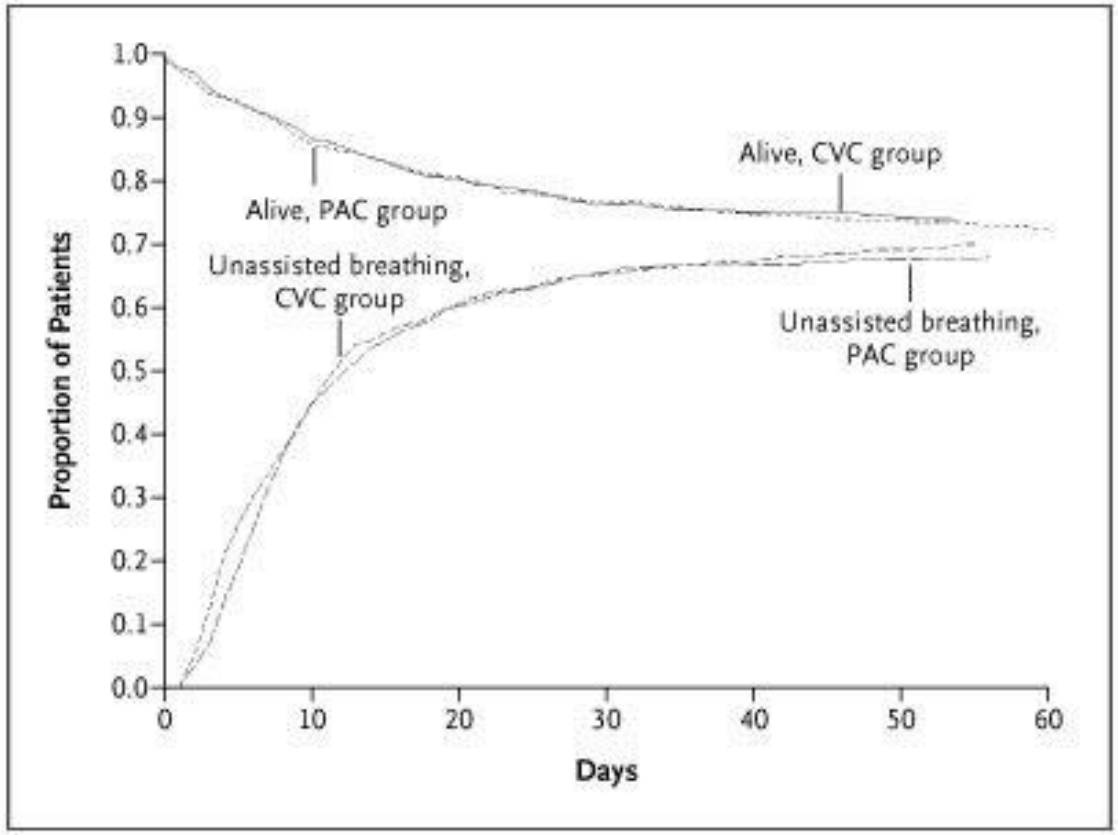
In our patients whom is oliguric (AKI), the intern on MICU rotation wants to place a pulmonary artery catheter to obtain the PAOP (i.e., wedge pressure), as opposed to your management, if this is done it is most likely to result in which of the following (Single (best) Answer)?

(A) Decreased 28-day mortality
(B) Decreased length of ICU stay
(C) No identifiable benefit
(D) Decreased incidence of renal dysfunction
(E) Fire the intern on the MICU rotation

Pulmonary-Artery versus Central Venous Catheter to Guide Treatment of Acute Lung Injury

- **Hemodynamic monitoring is a common physiological intervention in patients with acute lung injury.**

- **In this randomized, controlled trial no significant difference in 60-day mortality whether monitoring was performed with a pulmonary-artery catheter or a central venous catheter.**



Graph: Kaplan-Meier Estimates of the Probability of Survival and of Survival without the Need for Assisted Ventilation during the First 60 Days after Randomization

The National Heart, Lung, and Blood Institute Acute Respiratory Distress Syndrome (ARDS) Clinical Trials Network
N Engl. J Med 2006;354:2213-2224

Case Presentation - Question

Our same 69 year-old woman with septic shock developed diffuse bilateral infiltrates and progressive hypoxemic respiratory failure (Pa/FiO_2<100) necessitating mechanical ventilation.

She is 5'3" (160 cm) and weights 198 pounds (90 kg). The RT asks you after intubation "what tidal volume you want on the ventilator". *Your best response is ?*

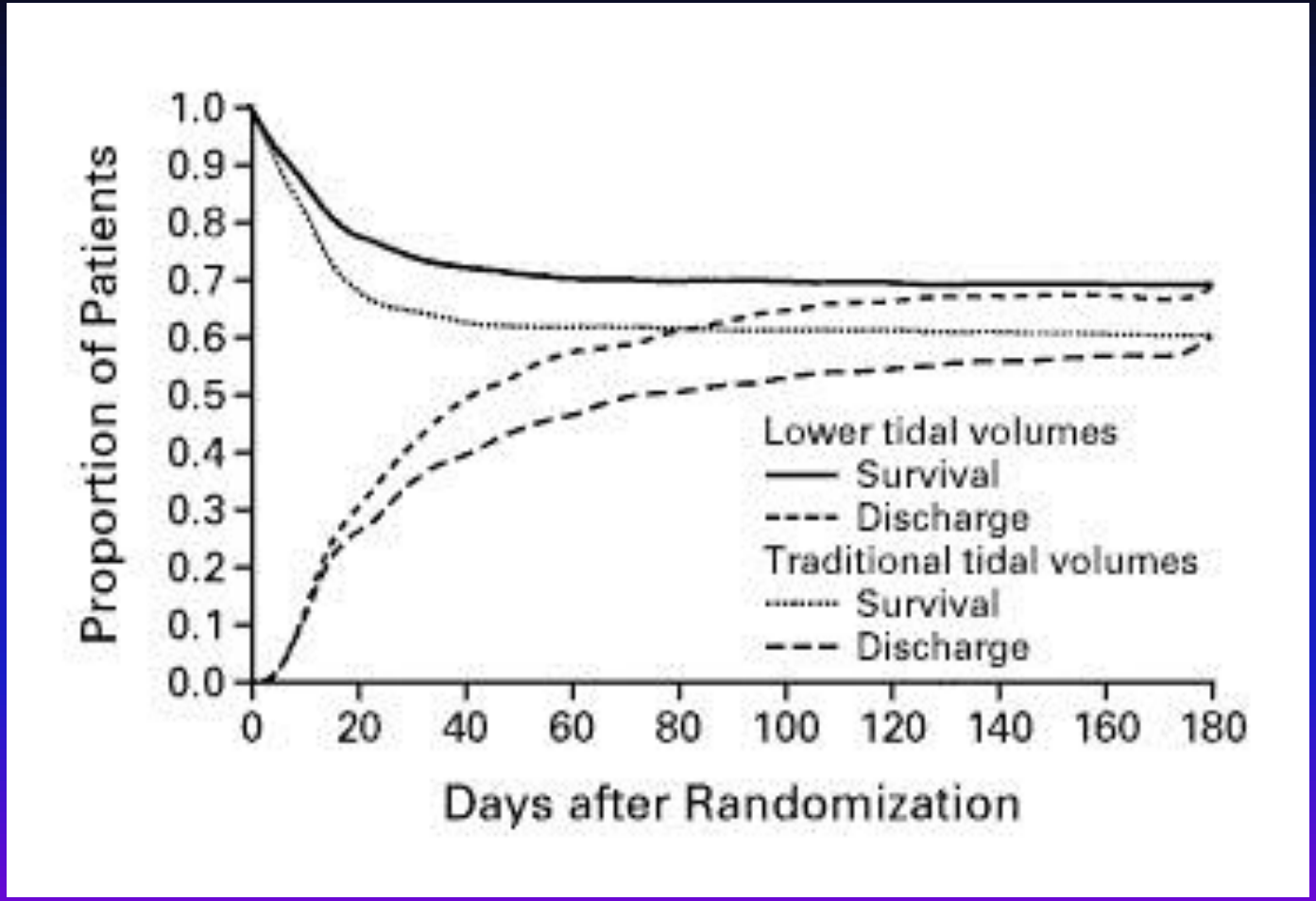
(A) 314 ml
(B) 430 ml
(C) 540 ml
(D) 665 ml

Females: PBW (kg) = 45.5 + 2.3 (height (in) – 60)
kg = 45.5 + 2.3 (63 – 60)
kg = 45.5 + 6.9
kg = 52.4

52.4 x 6 cc/kg = 314.

Probability of Survival and of Being Discharged Home and Breathing without Assistance in ARDNet

- Acute lung injury & acute respiratory distress syndrome
- A multicenter, randomized trial
- Compared traditional ventilation, initial tidal volume of 12 ml/kg of and an (plateau pressure) of 50 cm of water or less, with ventilation with a lower tidal volume, which involved an initial tidal volume of 6 ml/kg and a plateau pressure of 30 cm of water or less.



Ventilation with Lower Tidal Volumes as Compared with Traditional Tidal Volumes for Acute Lung Injury and the Acute Respiratory Distress Syndrome. N Engl. J Med 2000; 342:1301-1308.

Case Presentation - Question

Which of the following statement is correct (Single Answer) about the Berlin Definition of ARDS for this patient who had a P/F ratio of ~85 at intubation, AKI and shock?

(A) This is categorized as moderate ARDS

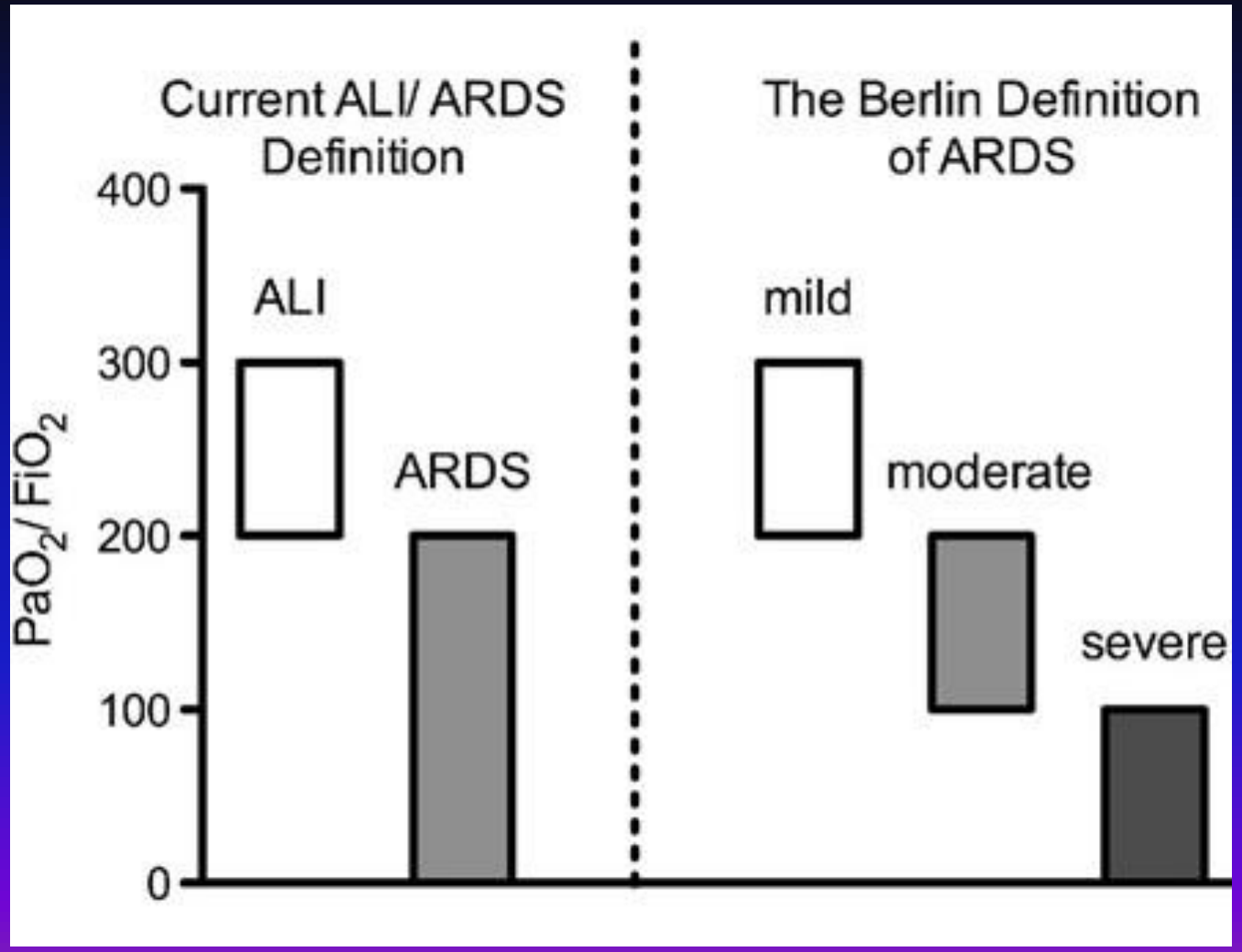
(B) Because she had urosepsis, this would not be ARDS

(C) Her predicted hospital mortality would be less than 20%

(D) We need a wedge pressure to determine if ALI is present

(E) None of the above is true

To review salient points about BERLIN Definition of ARDS within the context of this particular patient example.



Berlin = Better defined cohort

Mortality:

Mild	27%
Moderate	32%
Severe	45%

Acute Respiratory Distress Syndrome: The Berlin Definition. JAMA. 2012;307(23):2526-2533

Case Presentation - Question

Our patient's is currently on 0.60 FiO_2 using assist control with a set rate of 22, Vt of 6 ml/kg, and PEEP of 14 cm H_2O. The blood gas is pH 7.39, $PaCO_2$ 42 mmHg, PaO_2 of 71 mmHg. The plateau airway pressure (Pplat) on the ventilator is 41 cmH_20.

What if anything is needed at this point the patients care to improve survival?

(A) Do nothing things she has improved
(B) Place a chest tube to decrease the Pplat pressures
(C) Add bronchodilators to lower airway resistance
(D) Adjust the ventilator

Case Presentation - Question

Hopefully you answered adjust the ventilator. *Then how would you change the ventilator in hopes to improve survival?*

AC of 22, 0.60 FiO_2 with a Vt of 6 ml/kg, PEEP of 14 cm H_2O.

ABG = pH 7.39, $PaCO_2$ 42 mmHg, PaO_2 of 71 mmHg.

Plateau airway pressure (Pplat) on the ventilator is 41 cmH_20.

(A) Lower respiratory rate to allow permissive hypercapnia

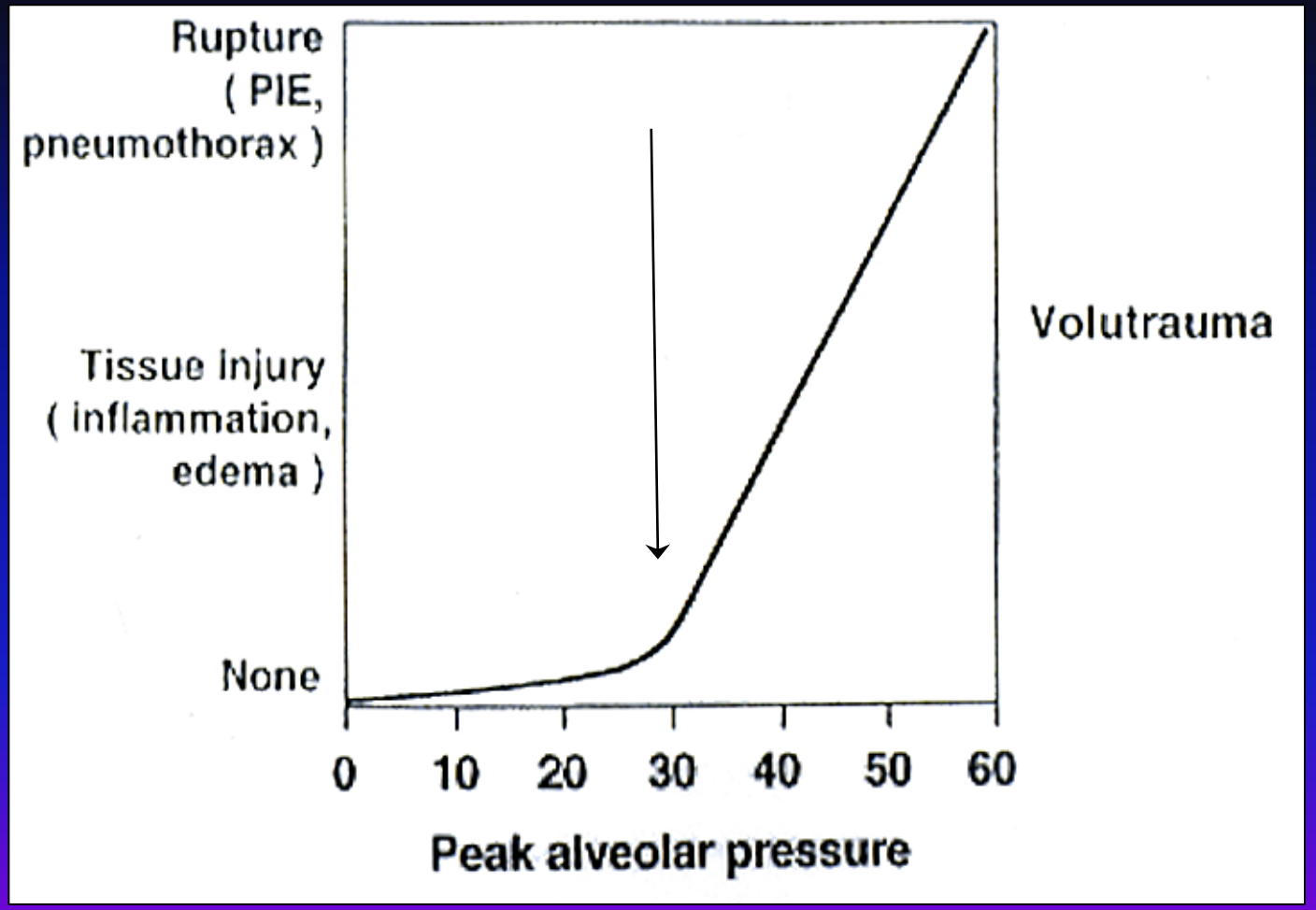
(B) Increase the ventilator flow rate

(C) Lower the tidal volume to compliance < 30

(D) Change to Airway pressure release ventilation

Curr Opin Crit Care. 2005 Jun;11(3):294.

Probability of Survival and of Being Discharged Home and Breathing without Assistance in ARDNet



Ventilation with Lower Tidal Volumes as Compared with Traditional Tidal Volumes for Acute Lung Injury and the Acute Respiratory Distress Syndrome. N Engl. J Med 2000; 342:1301-1308.

Case Presentation - Question

Our patient is hospital day 6 now, with a Pplat of 28, and $PaCO_2$ of 47 mmHg. However remains on AC with FiO_2 of 0.7 and 14 cmH_20 of PEEP. Her P/F ratio remains at 85? *Which of the following treatment may improved survival?*

(A) Start EMCO

(B) Palliative Care consult

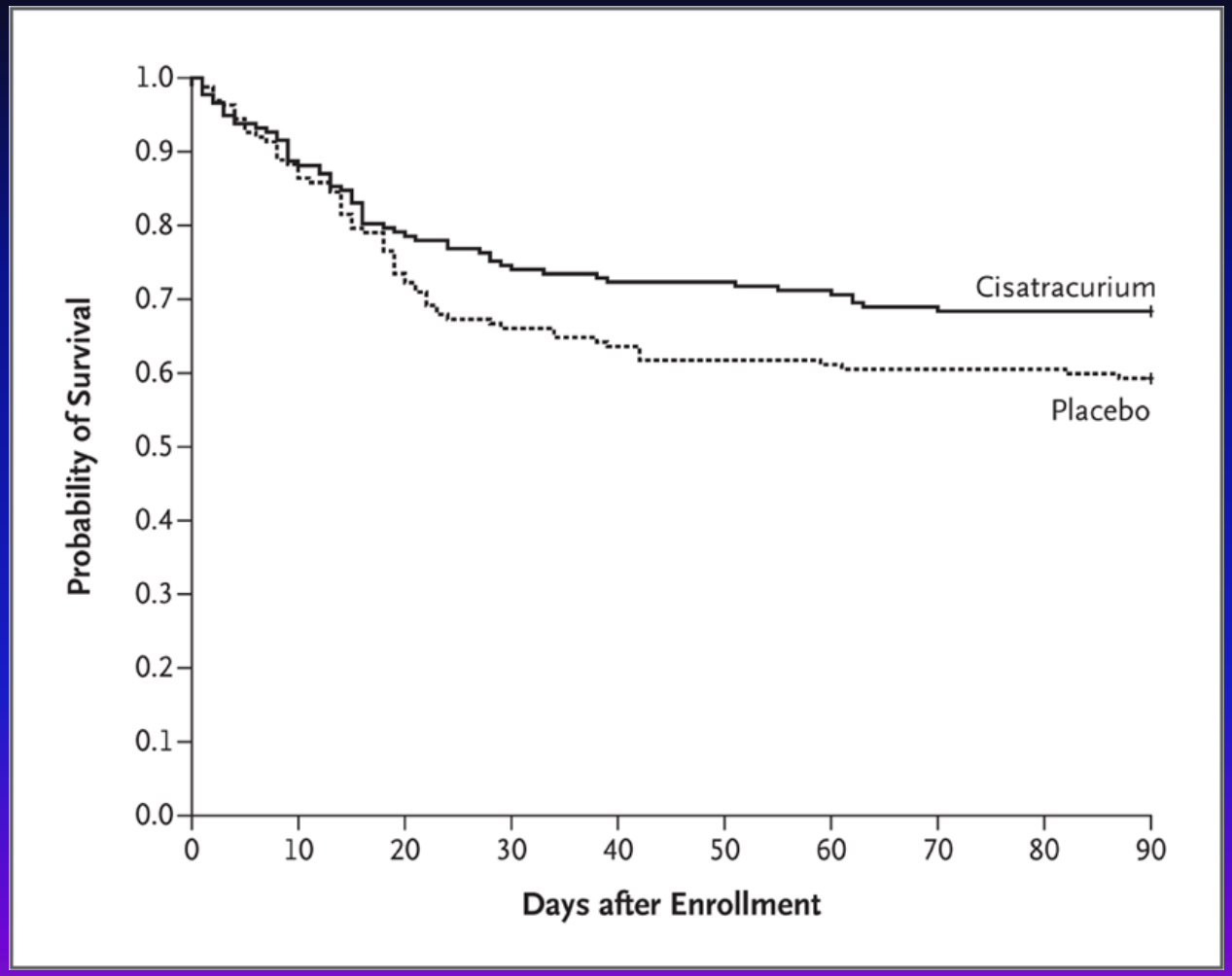
(C) Start prone ventilation

(D) Add neuromuscular blockade

Guerin D et al. PROSEVA Study group. Prone positioning in severe ARDS. NEJM 2013; 368(23): 2159-68.

Neuromuscular Blockers in Early Acute Respiratory Distress Syndrome.

- Multicenter, double-blind trial, with onset of severe ARDS within the previous 48 hours were randomly assigned to receive, for 48 hours, either cisatracurium besylate (178 patients) or placebo (162 patients).
- Severe ARDS was defined as a ratio PaO_2/FiO_2 of less than 150, with a PEEP of ≥ 5 cm and a tidal volume of 6 to 8 ml/Kg predicted body weight.
- In Severe ARDS, early administration of a neuromuscular blocking agent improved the adjusted 90-day survival and increased the time off the ventilator without increasing muscle weakness.



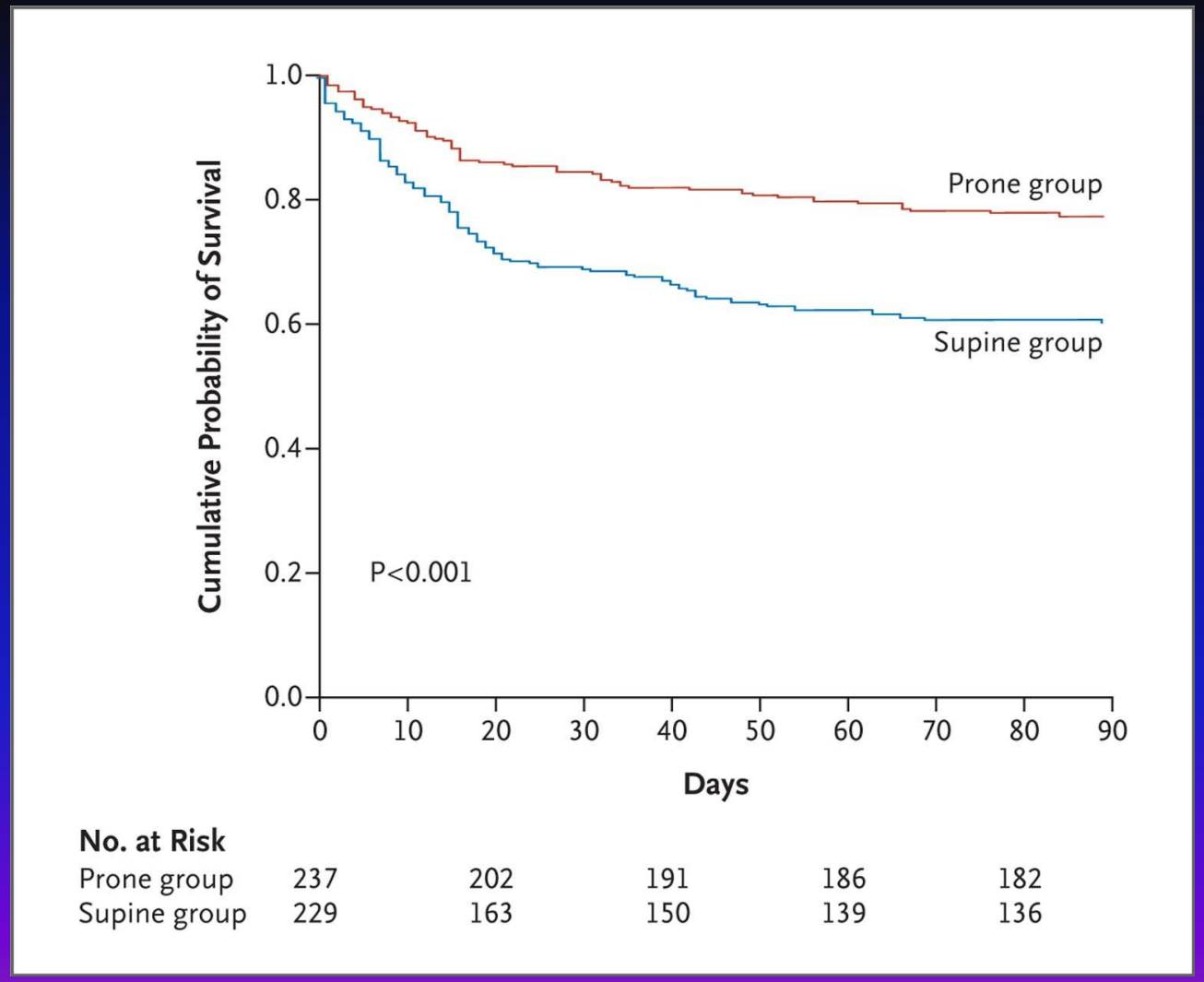
Papazian L et al. N Engl J Med 2010;363:1107-1116

Prone Positioning in ARDS

- **Guerin Study in the NEJM (2013) used a P/F <150 (slightly different than the more strict Berlin cutoff of 100) and 60% or more FiO_2 to demonstrate a large survival advantage (HR 0.4 for 90-day mortality).**

- **The proning was used for at least 16 hours/day and was stopped when P/F >150 on PEEP <10 and FiO2 <60%.**

Video Video



Guérin C et al. N Engl. J Med 2013;368:2159-2168

Case Presentation - Question

Which of the following statements regarding management of this patient with severe ARDS is TRUE (Single Answer)?

(A) Neuromuscular blockade should be used for mild & moderate ARDS.

(B) HFO is an early choice as established by recent RCTs.

(C) Prone positioning is an management strategy for severe ARDS

(D) Corticosteroids should be started early and often in ARDS

(E) Early tracheostomy is a proven way to reduce LOS and mortality.

Case Presentation - Question

Applause

ALL your hard work (and the patients) is working. It is now day 6, and this same patient with ARDS/sepsis is out of shock and off vasopressors. She remains sedated and on the ventilator. You are not sure of her fluid status, but she is clinically edematous though oliguric.

For patient who are stabilized and out of shock, with the ventilator being gradually reduced, which of the following steps in management have been shown to be **helpful in reducing ventilator days, ICU days and improved oxygenation.** (Single Answer):

(A) Avoid diuretics and keep CVP >12 due to oliguria
(B) Give diuretics and minimize fluids to goal CVP < 4
(C) Transfuse the patient to maintain Hgb levels of 8 g/dL
(D) Start steroids for late phase ARDS
(E) Once the patient passes an SBT, discontinue sedation

Comparison of Two Fluid-Management Strategies in Acute Lung Injury

Conservative strategy improved:

- **Improved oxygenation**
- **↓ duration of Mech. Vent.**
- **↓ intensive care days**
- **Without increasing nonpulmonary-organ failures**

Table 1. Duration of Mechanical Ventilation.*

Fluid Strategy	No. of Patients	No. of Days of Mechanical Ventilation		
		Mean	Median	Standard Error
Liberal	356	13.59	9.00	0.77
Conservative	375	10.37	6.00	0.66

* P<0.001 by the Wilcoxon test.

No significant difference in 60-day mortality

The National Heart, Lung, and Blood Institute Acute Respiratory Distress Syndrome (ARDS) Clinical Trials Network
N Engl. J Med 2006;354:2564-2575

Case Presentation - Question

Our legionary patient is hospital day 8. Examination reveals scattered course breathing sounds. After 20 minutes of a spontaneous breathing trial (SBT), blood pressure is 135/90 mmHg. Pulse rate is 100/min; respiratory rate is 28/min and oxygen saturation is 92% on a FiO_2 of 0.35. The SBT is without the evident onset of arrhythmia, respiratory distress, diaphoresis, or anxiety. Chest radiograph shows clearing of diffuse infiltrates. *Which of the following is the most appropriate management?*

(A) Obtain arterial blood gas studies

(B) Continue mechanical ventilation and reassess

(C) Extubate and discontinue mechanical ventilation

(D) Extubate then initiate noninvasive mechanical ventilation

Kress JP. Weaning patients from mechanical ventilator. New England Journal of Medicine 2002; 367(23): 2233 -2239.

Case Presentation - Question

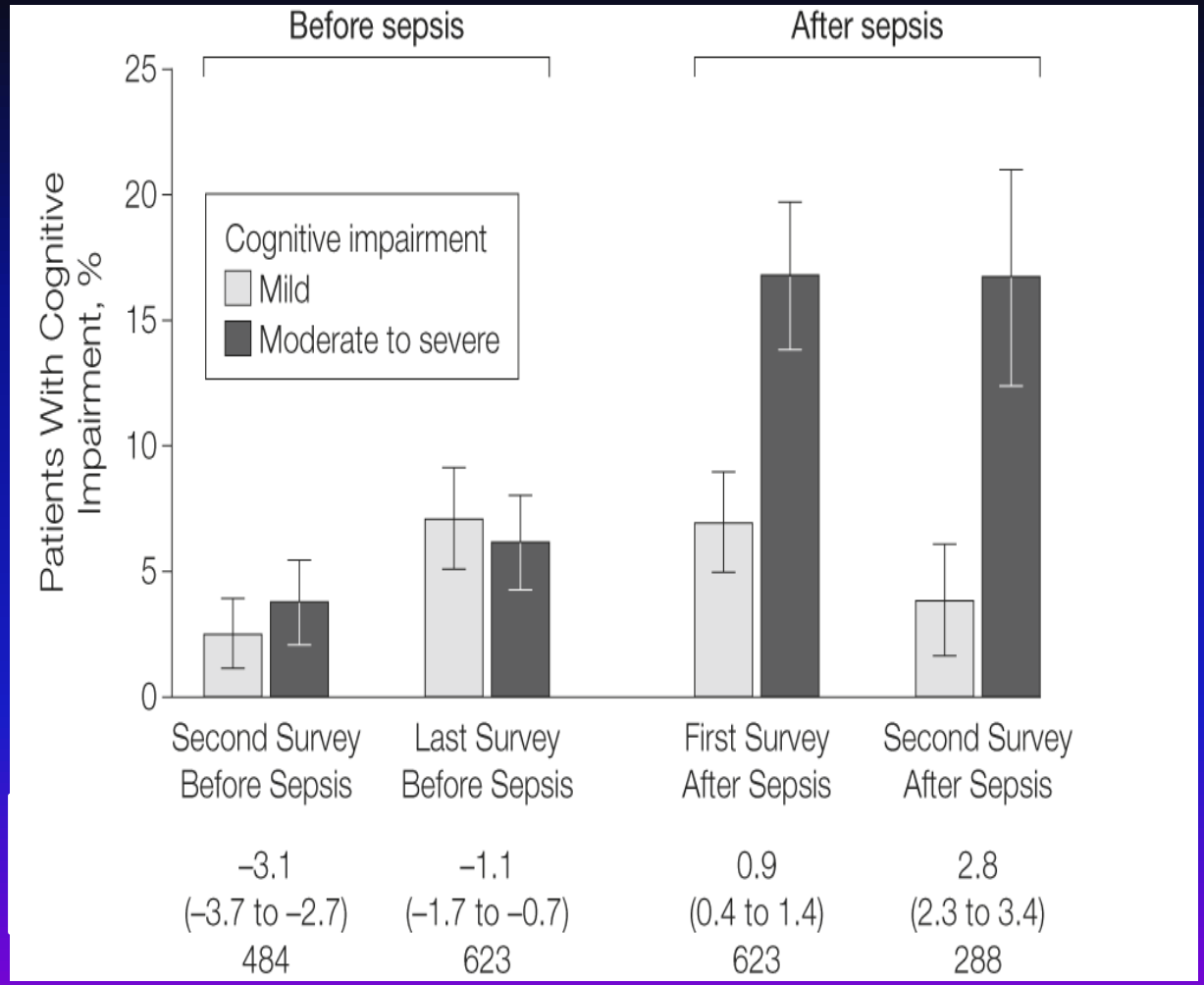
Which of the following states is true regarding post ICU recovery?

A. **Most sepsis survivors are back to work in 6 months**
B. **There is cognitive impairment post sepsis, even in mild disease**
C. **There is nothing that can be done to improve post ICU recovery**
D. **Daily interruption of sedation has the *least impact* on post ICU recovery**

The Effects of Critical Illness

- A prospective cohort involving 1194 patients with 1520 hospitalizations for severe sepsis drawn from the Health and Retirement Study, a nationally representative survey of US residents (1998-2006).

- A total of 9223 respondents had a baseline cognitive and functional assessment; 516 survived severe sepsis and 4517 survived a non-sepsis hospitalization to at least 1 follow-up survey and are included in the analysis.



Iwashyna T JAMA 2010; 304: 1787 - 1794

Case Presentation - Question

In accordance with the 2016 SCCM Sepsis Guidelines for management of patients such as this, the literature supports which of the following statements as GRADE 1 (highest level) (Single Answer)?

(A) Plateau Pressure should be maintained <30 cm H2O
(B) Ventilator weaning protocols with SBTs
(C) Sedation protocols and minimization of sedation
(D) All of the above
(E) None of the above

ICU Medicine Board Answer Keys to Conclusions

- Volume resuscitation with saline (30 cc/kg)
- No CVP or PAOP needed, Protocols are not needed!
- After shock resolves then start diuresis (conservative fluids)
- ARDS is still a syndrome: Berlin Criteria is the scoring system
- Treatment Criteria changes with severity, however 6 cc/kg (ideal)
- Keep the Plat Pressure < 30 in ARDS
- SBT, Sedation vacation reduce ICU LOS & cognitive impairment