Project: Ghana Emergency Medicine Collaborative

Document Title: Acute Congestive Heart Failure

Author(s): Rashmi U. Kothari (Michigan State University), MD 2012

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68 y.o. Female with Severe Shortness of Breath

P=130 RR=32 BP=220/120 P.Oxm=86%➔90%

Differential Diagnosis

- PE
- CHF/Pulmonary edema
- Pneumonia
- COPD
- Pneumothorax
- Pericardial effusion

68 y.o. Female with Severe Shortness of Breath

- History
  - Onset (gradual or sudden)
  - Cough, fever, unilateral leg swelling
  - Orthopnea, PND, DOE, Swelling
  - PMH: CAD, CHF, PE/DVT, ESRD
  - Same it past?

68 y.o. Female with Severe Shortness of Breath

- Physical Exam
  - VS: (T/RR/HR/BP/Pulse Oxm)
  - Neck: JVD
  - Chest: ↓ BS, rales, wheezing, rhonchi
  - Heart: Afib, bradycardia, distant HS, S3
  - Extremities: edema, unilateral swelling, cord, tenderness

68 y.o. Female with Severe Shortness of Breath

- HPI: 3-4 days, cough, ↑↑worse this am
- PMH: COPD, CHF, CAD, & HTN
- PE: Obese, severe resp. distress

- Chest: ↓ BS, ?rales, ?wheezing
- Cardiac: RRR no Murmur
- Extremities: 2+ bilateral edema

Goal

- Review pathophysiology
- Evaluate diagnostic findings
  - H&P, CXR, BNP, U/S
- Evaluate medical management
  - Oxygen delivery, nitroglycerin, lasix, morphine

Acute Congestive Heart Failure (CHF)

- Definition

Diagnosis

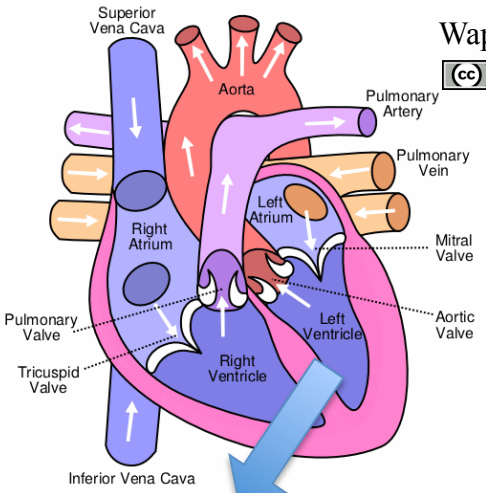
- History & Physical Exam
- Chest X-ray
- Laboratory tests
- Ultrasound

Diagnosing CHF

Increased Likelihood		Decreased Likelihood	
• Hx CHF	LR=5.8	• No hx CHF	LR=.45
• PND	LR=2.6	• No DOE	LR=.48
• S3	LR=11	• No rales	LR=.51
• + CXR	LR=12	• -Cardiomegaly	LR=.51
• Afib	LR=3.8	• EKG WNL	LR=.64

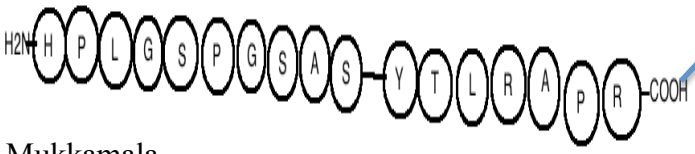
Wang et al. JAMA 2005

Myocardial stretch/stress

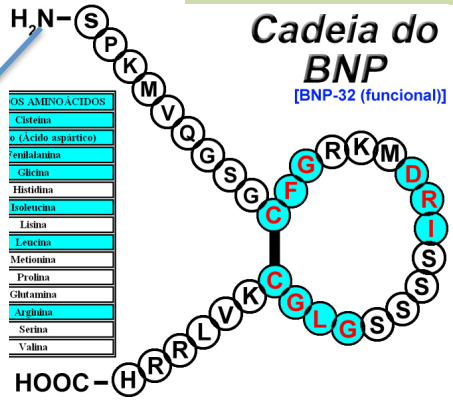


Wapcaplet, Wikimedia Commons

Pro-BNP



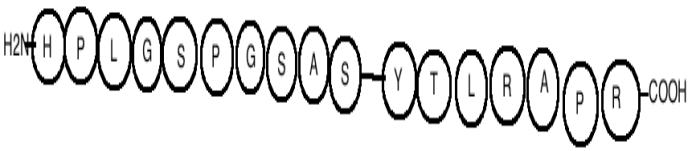
A. Mukkamala



Cadeia do BNP

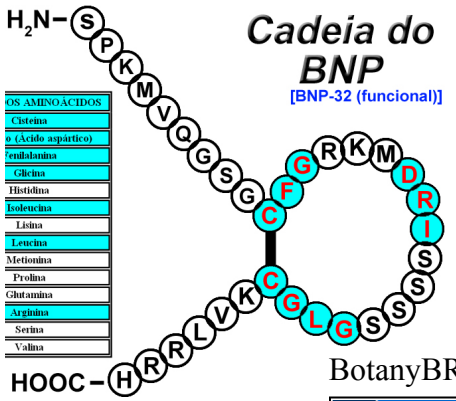
[BNP-32 (funcional)]

NT-pro-BNP



A. Mukkamala

BNP



Cadeia do BNP

[BNP-32 (funcional)]

BotanyBRA, Wikimedia Commons

BNP and NT pro-BNP

	BNP		NT pro-BNP	
AGE	All	<50	50-70	>70
Rule out	<100	<300	<300	<1200
Sens/Spec	90%/74%	99%/85%	99%/85%	97%/55%
Rule in	>400	>450	>900	>4500
Sens/Spec	81%/90%	93%/95%	91%/80%	64%/86%

References:
Korenstein BM Emerg Med 2007
Jannuzi et al Am J Card 2005
Berdague et al., Am Heart J

Impact of High & Low BNP on Pre-Test Probabilities

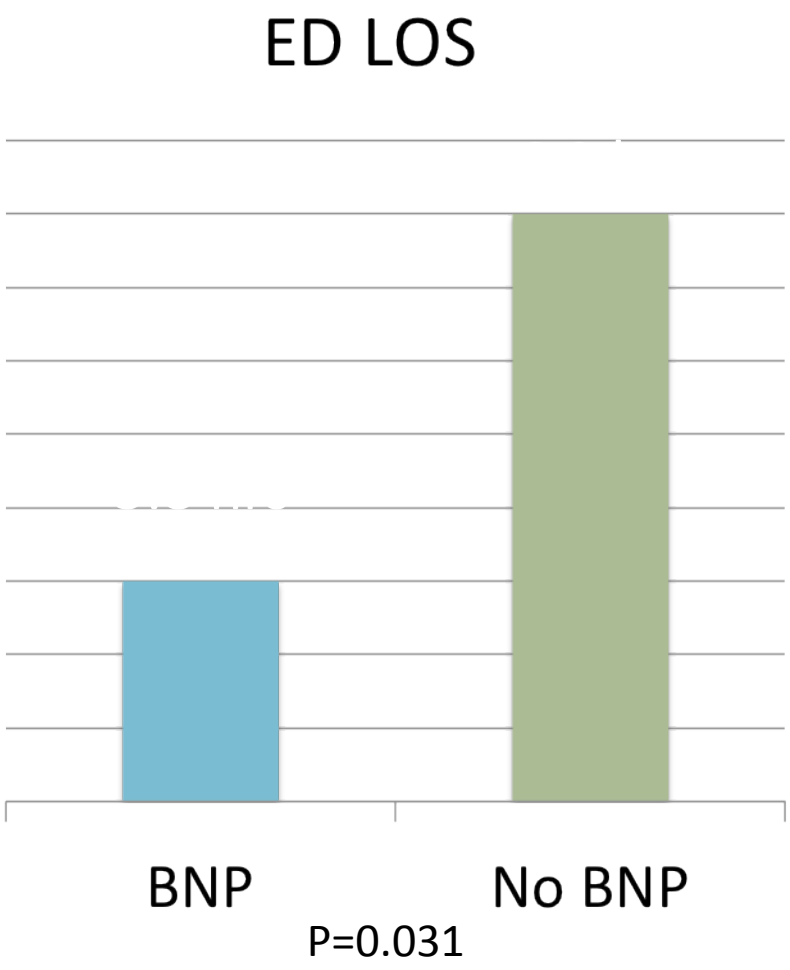
Pre-test Probability	Post-test Probability for BNP<105 pg/ml	Post-test Probability for BNP >300 pg/ml
10%	2%	46%
30%	5%	77%
50%	12%	88%
70%	25%	95%
90%	56%	99%

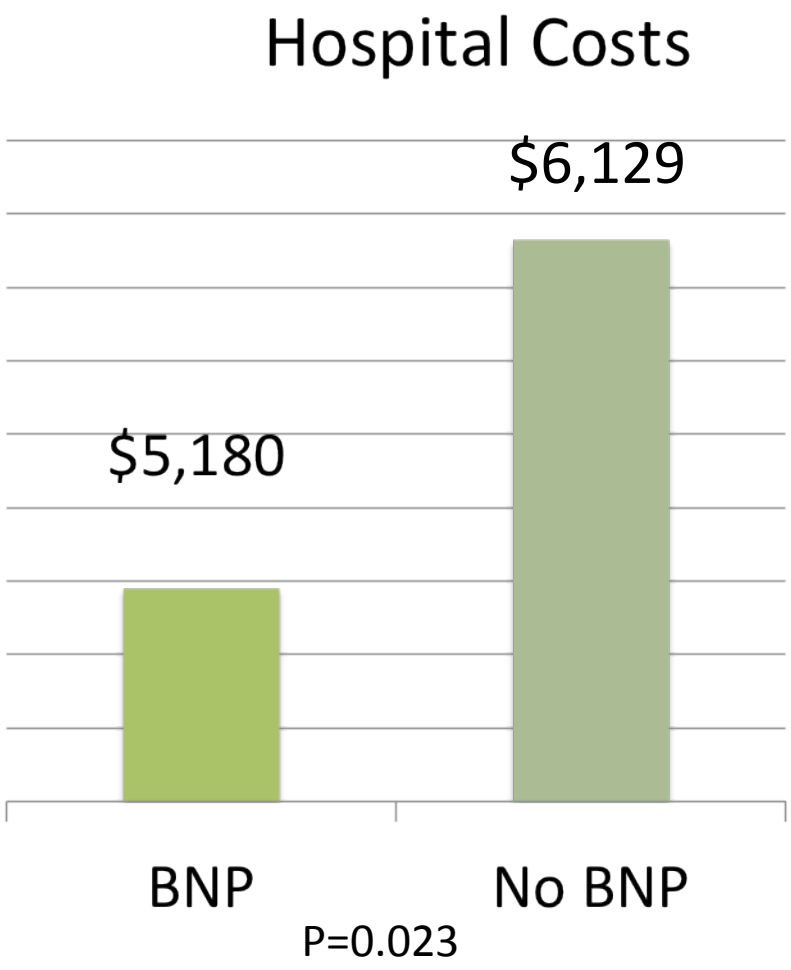
Reference: Korenstein Et. al.,BM Emerg Med 2007

Causes of Elevated BNP

- Acute CHF
- Renal Failure
- Sepsis
- Pulmonary Embolism

BNP Decreases LOS & Cost





Reference: Mueller et.al., NEJM

Reference: Moe et. al., Circ 2007

Summary of BNP

- Combining clinical judgment & BNP
  may improve accuracy of diagnosis

- Most helpful when diagnosis unclear (e.g. COPD)

- Can be elevated in ARF, sepsis or PE

Diagnosing CHF by Ultrasound

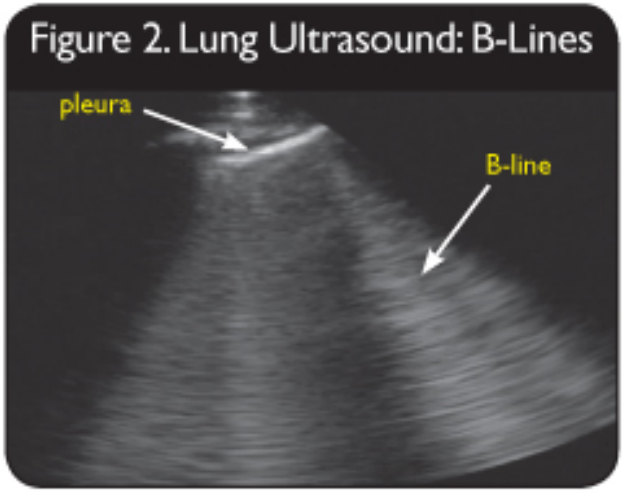
- Extravascular lung fluid
  - Look for “comet tails”

- Elevated Rt heart filling pressures
  - Examine IVC within 2 cm of Rt atrium

Ultrasound B-lines (Lung Rockets) in CHF

- Pros:
  - Easy windows
  - 80-90% sensitivity & specificity
- Cons:
  - Takes 2-5 minutes
  - Limited data from ED

Lung Ultrasound for B-Lines (Lung Rockets)



- Use a 3-5 MHz Probe
- Position 1: anterior chest view
- Position 2: lateral chest views

Measuring IVC by Ultrasound in AHF

- Pros:
  - Rapid
  - 69%PPV & 91% NPV
  - Accuracy 83% for ↑ Atrial Pressures
- Cons:
  - Correlation ↑ Atrial Pressures to AHF
  - Technically challenging

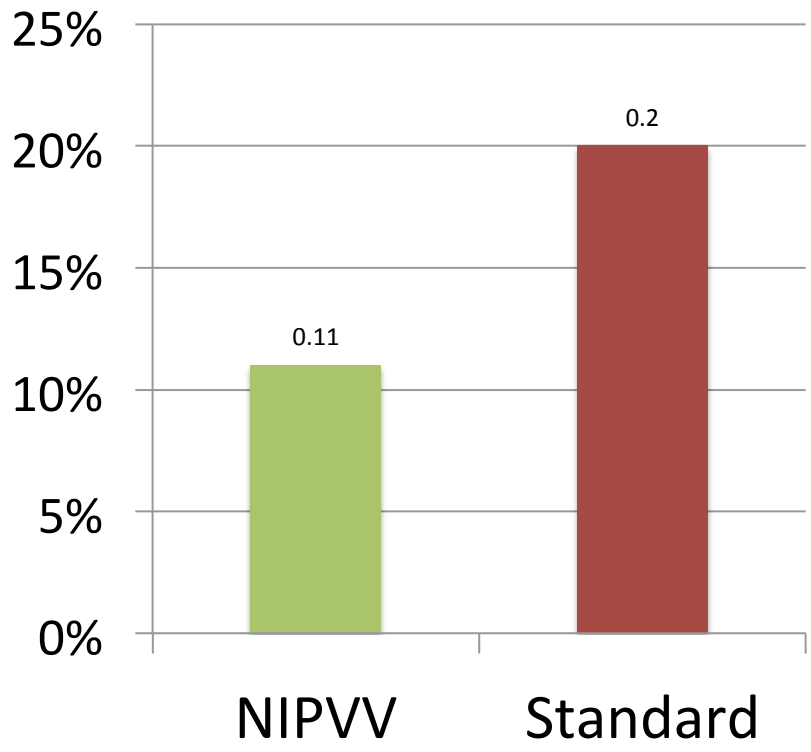
Reference: Blair JE, et al: Am J Card 2009

Management of Acute CHF

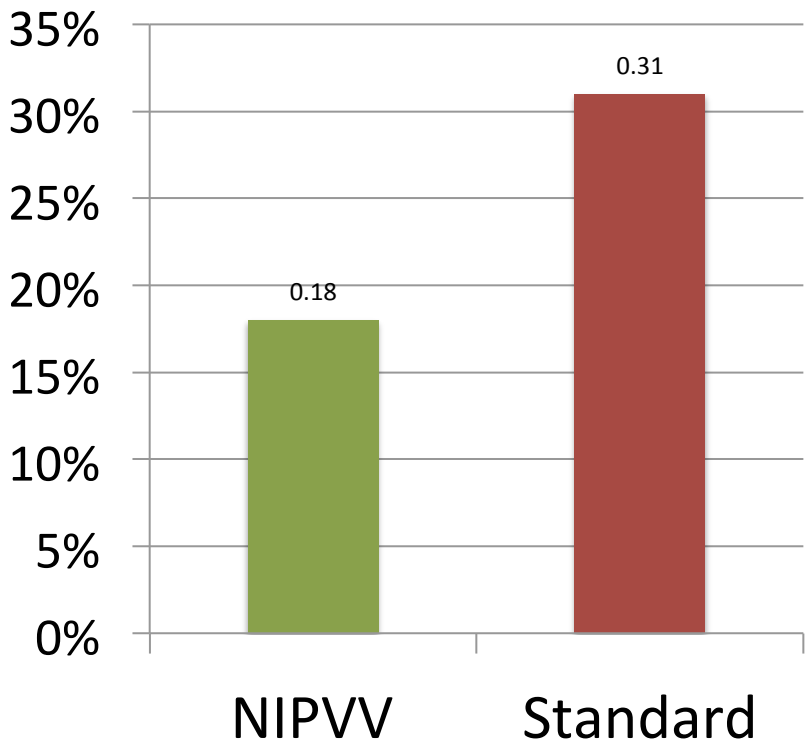
- Oxygen
- Diuretics
- Nitroglycerin
- Morphine

CPAP/BiPAP Decreases Mortality & Intubation

45% ↓ mortality*



42% ↓ Intubation*



*p<0.001

Reference: Masip et al. JAMA 2005

Reference: Masip et al. JAMA 2006

CPAP & BiPAP Equivalent

CPAP = Bipap

- Mortality
- Intubation rates
- AMI

Mortality

CPAP	BiPAP
6%	7%

Reference: Masip et al. JAMA 2005

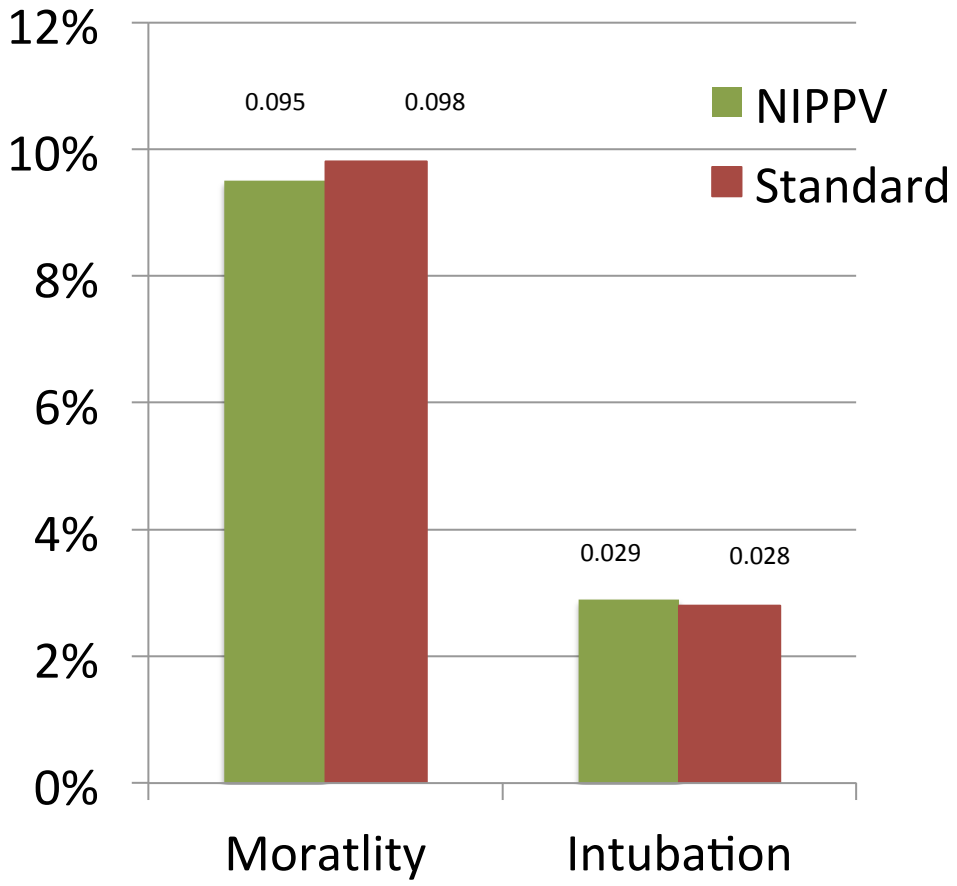
ED Study of NIPPV vs. Standard Medical Care (SMC)

- 1069 ED
- Randomized for 2 hrs of treatment
  - CPAP
  - BiPAP
  - Oxygen by NC or FM

Gray et al. NEJM 2008

No Difference NIPPV vs. SMC

- No Difference
  - Mortality
  - Intubation rates
- NIPPV better
  - ↓ Respiratory distress
  - ↓ Metabolic disturbances



Reference: Gray et al. NEJM 2008

Why Discrepancy Between Studies?

Study	Mortality	Intubation Rate
Gray et al. *NEJM*	16.5%???	2.8%
Masip et al *JAMA*	20%	31%
Cochrane	20%	30%

Reason for Discrepancy

Change in Treatment	Standard Oxygen (N=367)
Intubation	3
CPAP	43
NIPPV	13
Standard treatment	---
Type treatment not noted	6

65/367 (18%) Patients Crossed Over in Standard Treatment Group

Summary of NIPPV

- Most likely:
  - Decreases mortality
  - Decreases intubation rate
  - Decreases respiratory distress
- Use in Patients with:
  - Significant respiratory distress
  - O_2 Saturation <90%

68 y.o. Female in Severe CHF. Home Meds 80 mg Lasix

- How much IV Lasix should you give her?
  - None
  - 40 mg
  - 80 mg
  - 160 mg

Decreased Effectiveness of Loop Diuretics in CHF

- Delayed onset of action
  - 15-30 minutes normal patients
  - 45-120 minutes in CHF
- Drug resistance in chronic users

Cardiac Effects of Lasix

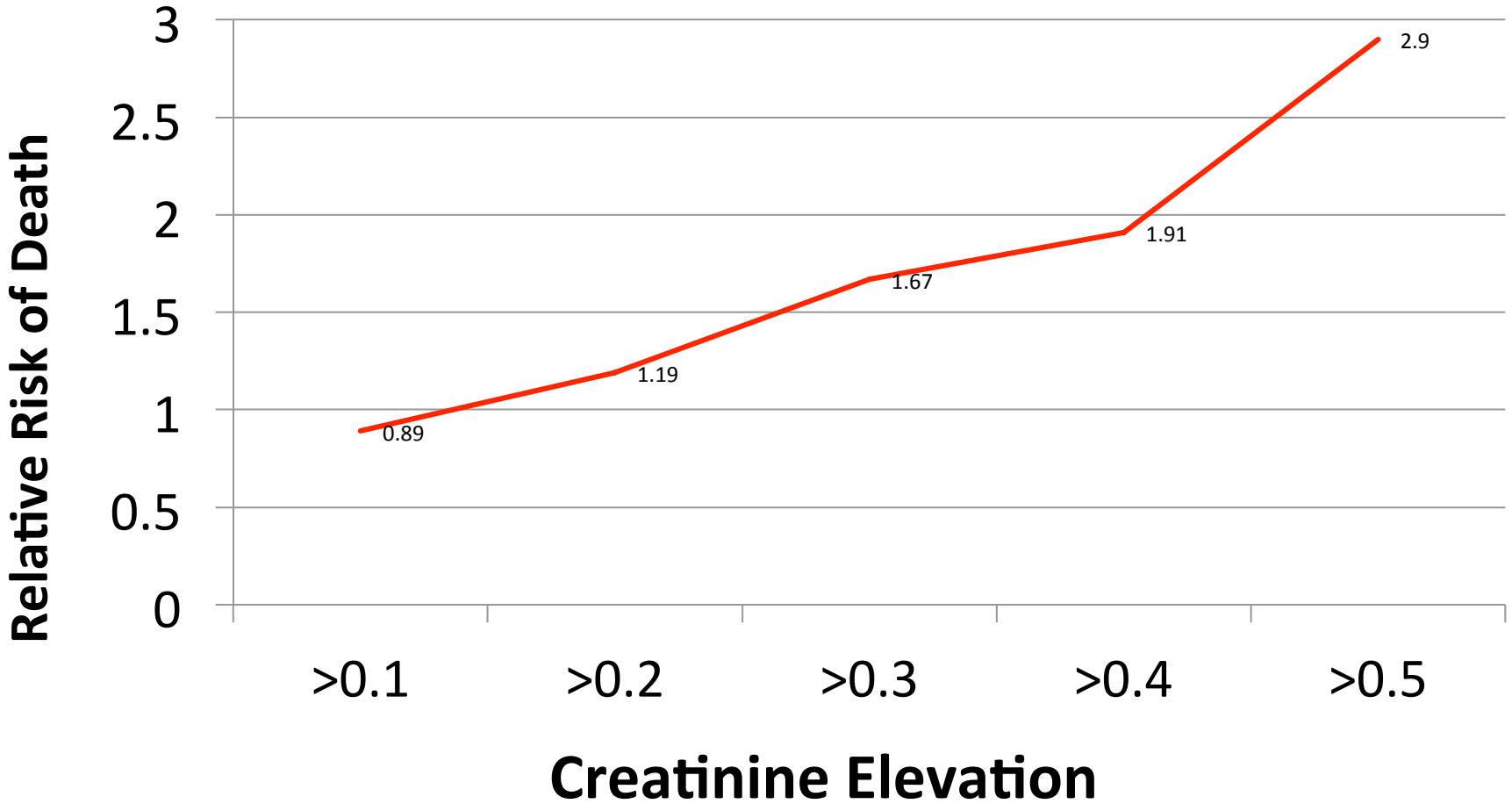
- Venous dilatation
  - Healthy subjects
  - Maximized @ 20 mg
- Arterial constriction
  - CHF patients
  - Predominates early

Physiological Effect	
PVR	↑
SVR	↑
MAP	↑
HR	↑
RtAFP	↑
SV??	↓
Catecholamines	↑

Worsening Creatinine and Acute Congestive Heart Failure

- Occurs in 72% of patients with CHF
- Increased mortality
- ↑ LOS

Increased Mortality Associated with Worsening Creatinine



Reference: Gottlieb et al. J Card Fail 2002