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# Fluids in Sepsis Keeping Pace

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# Disclosures – Pineapples and Palm Trees

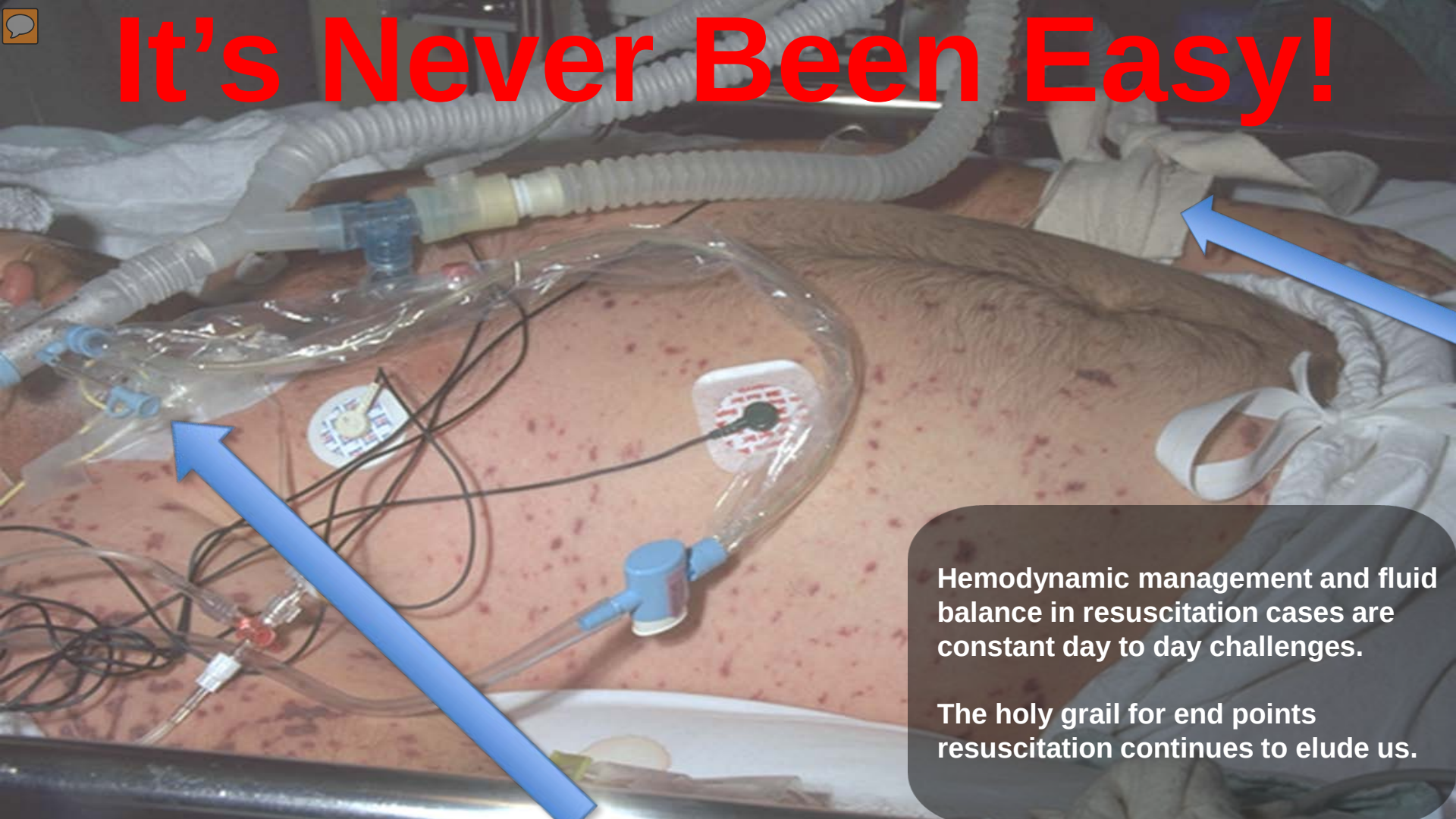
- None


**Baptist Health South Florida – 10+ Hospitals**

# Objectives

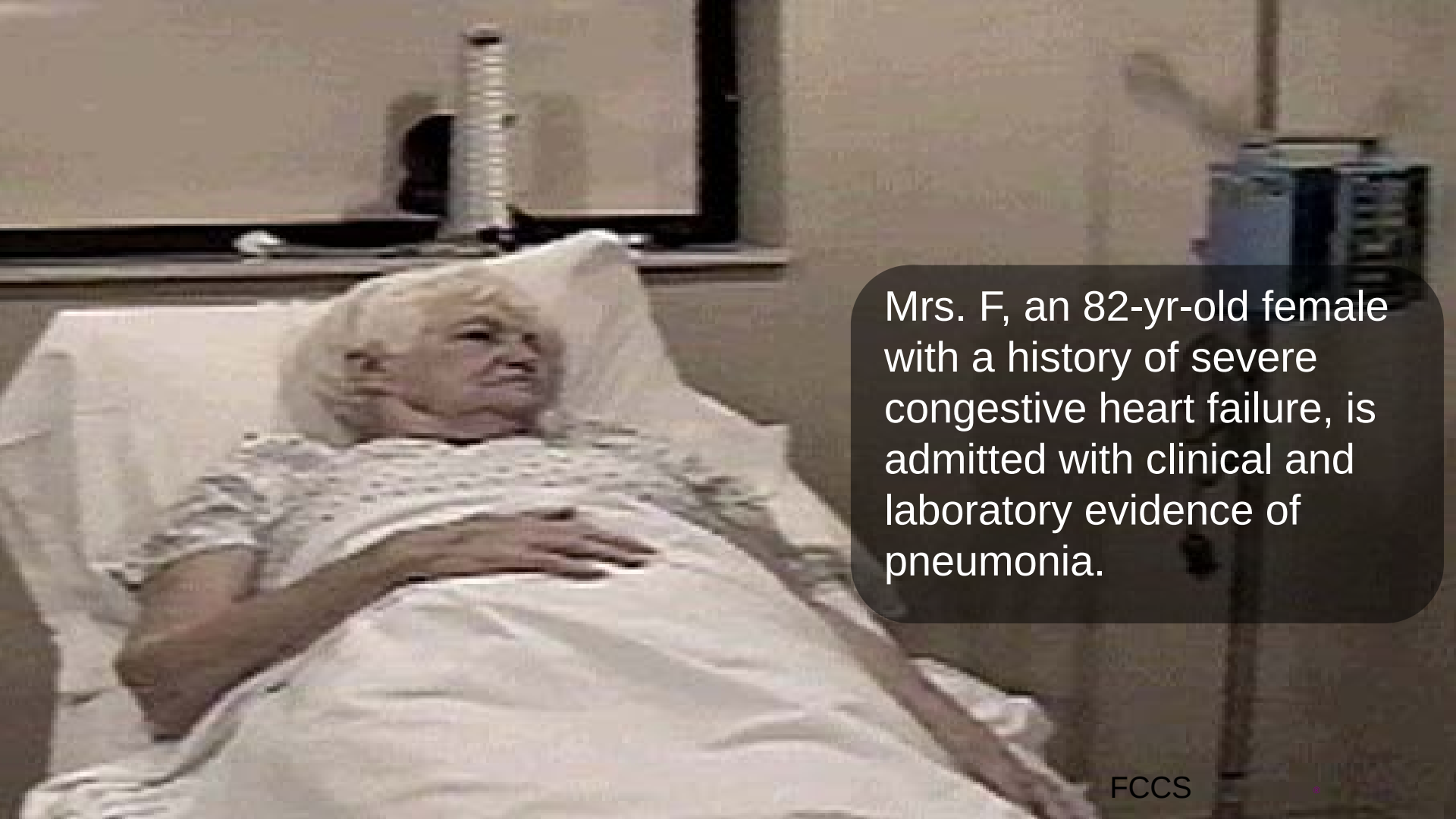
- Discuss factors used to identify need for fluids in sepsis patients.
- Describe fluid practice management options for sepsis.

# It's Never Been Easy!



Hemodynamic management and fluid balance in resuscitation cases are constant day to day challenges.

The holy grail for end points resuscitation continues to elude us.


Mrs. F, an 82-yr-old female with a history of severe congestive heart failure, is admitted with clinical and laboratory evidence of pneumonia.

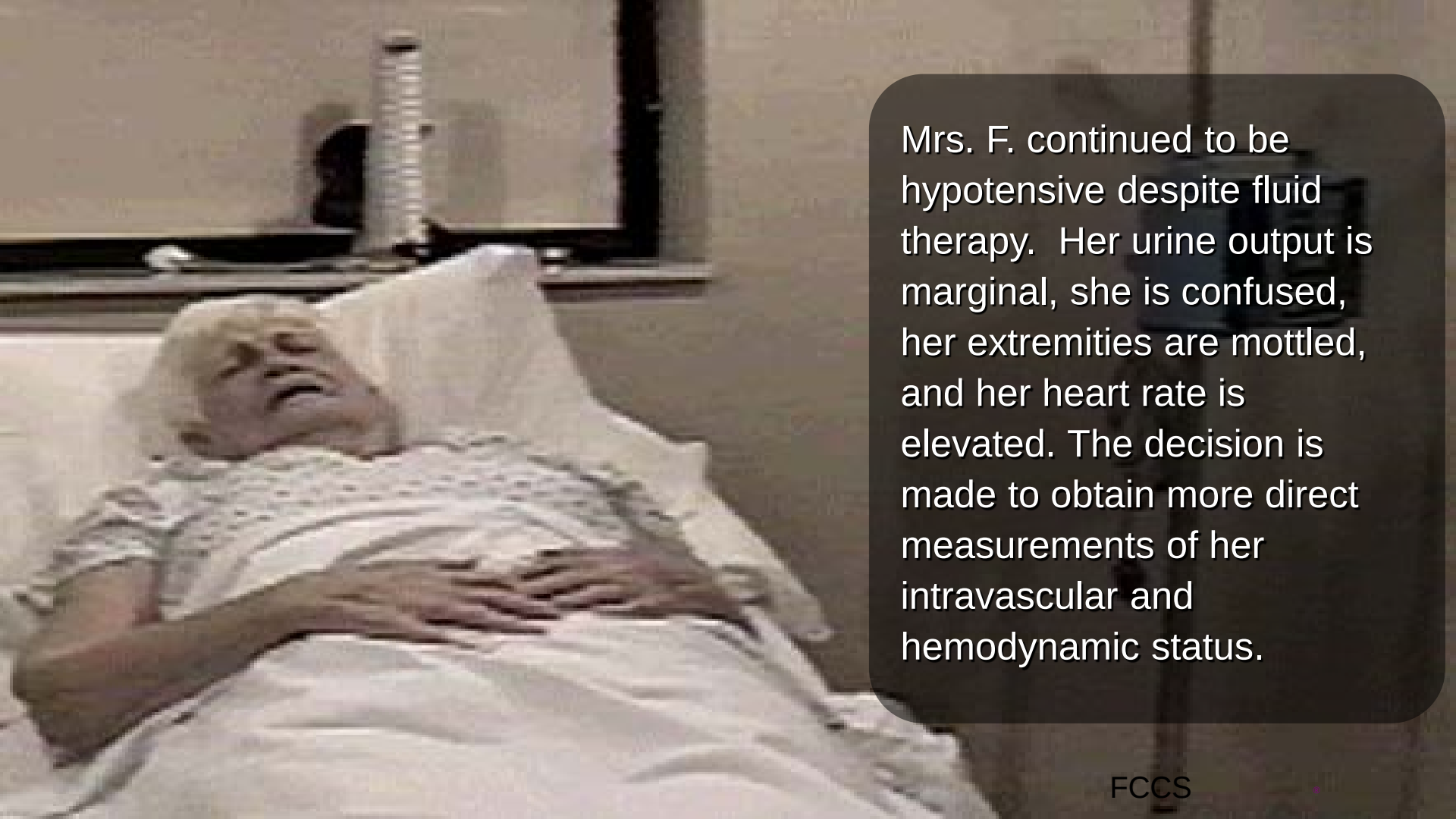
FCCS

Goals

- Confirm diagnosis
- Initiate treatment
- Monitor for improvement or worsening in her condition

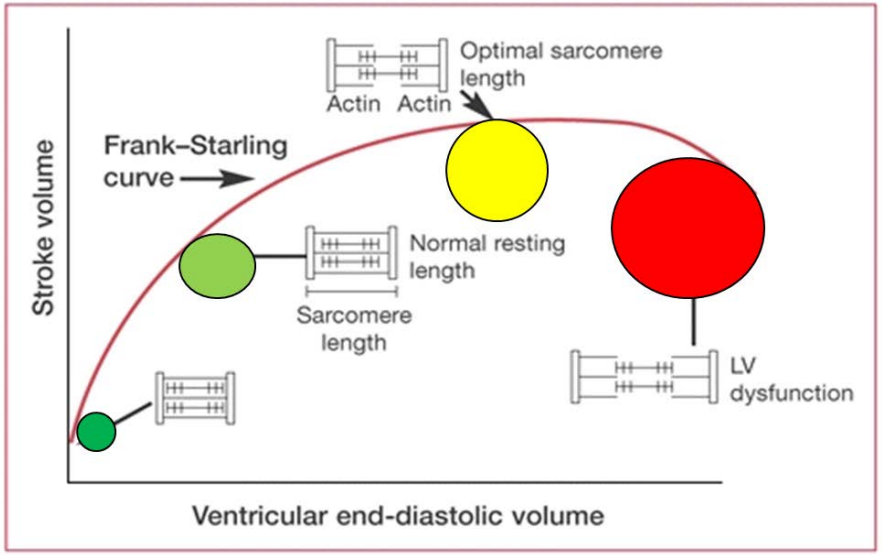
# Fluid Therapy

- **Why?**
  - **Correct hypotension first**
  - **Decrease heart rate**
  - **Correct hypoperfusion abnormalities**
  - **Monitor for deterioration of oxygenation**
  - **Infuse to physiologic endpoints**
  - **Which endpoints and how?**
- **Options:**
  - **Balanced Crystalloids**
  - **Colloids**
  - **Blood products**

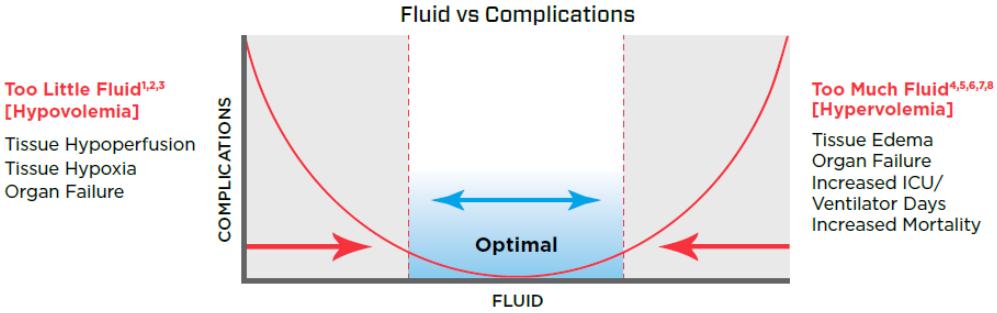


Mrs. F. continued to be hypotensive despite fluid therapy.  Her urine output is marginal, she is confused, her extremities are mottled, and her heart rate is elevated. The decision is made to obtain more direct measurements of her intravascular and hemodynamic status.

# The Sky is Blue




## FLUID IMBALANCE can lead to SERIOUS CONSEQUENCES




| | |
|---|---|
| **SEPSIS/SHOCK** | VOLUME OVERLOAD IN SEPTIC PATIENTS IS ASSOCIATED WITH AN INCREASED RISK OF MORTALITY.[6,7] |
| **SURGERY (ERAS)** | CAREFUL MANAGEMENT OF INTRAOPERATIVE FLUIDS CAN GREATLY ENHANCE PATIENT OUTCOMES.[5] |

# Hemodynamic Monitoring

**Accuracy?**
**Never therapeutic**
**Rarely diagnostic**
**Risk/benefit**
**Team process**

The ability to increase cardiac output after fluid administration requires functional hemodynamic monitoring

*"Not everything that counts can be counted, and not everything that can be counted counts."*

*- Albert Einstein*

# Hemodynamic *du jour* or *à la mode* ?

**Accuracy?**
**Never therapeutic**
**Rarely diagnostic**
**Risk/benefit**
**Team process**

- Heart rate and rhythm
- Preload – neck vein distension, lung findings, heart sounds, PLR, volume responsiveness
- Blood pressure – blood flow monitoring, various technical developments to assess fluid responsiveness (pulse pressure, pressure variations, PPV, SVV, LIDCO, PIDCO
- Closed loop hemodynamic management, peri-operative management
- Pressure surrogates for end diastolic volume - RVEDV – CVP, LVEDV- PAOP
- Physiologic determinants – SpO2, ETCO2, ABG, VBG, MvO2, SvO2, ScVO2, DO2/VO2
- Afterload – mean arterial blood pressure, systemic vascular resistance
- Contractility – SV, ejection fraction, echocardiography, POC ultrasound, trans-esophageal echocardiography

# Liberal Versus Restrictive Intravenous Fluid Therapy for Early Septic Shock: Rationale for a Randomized Trial

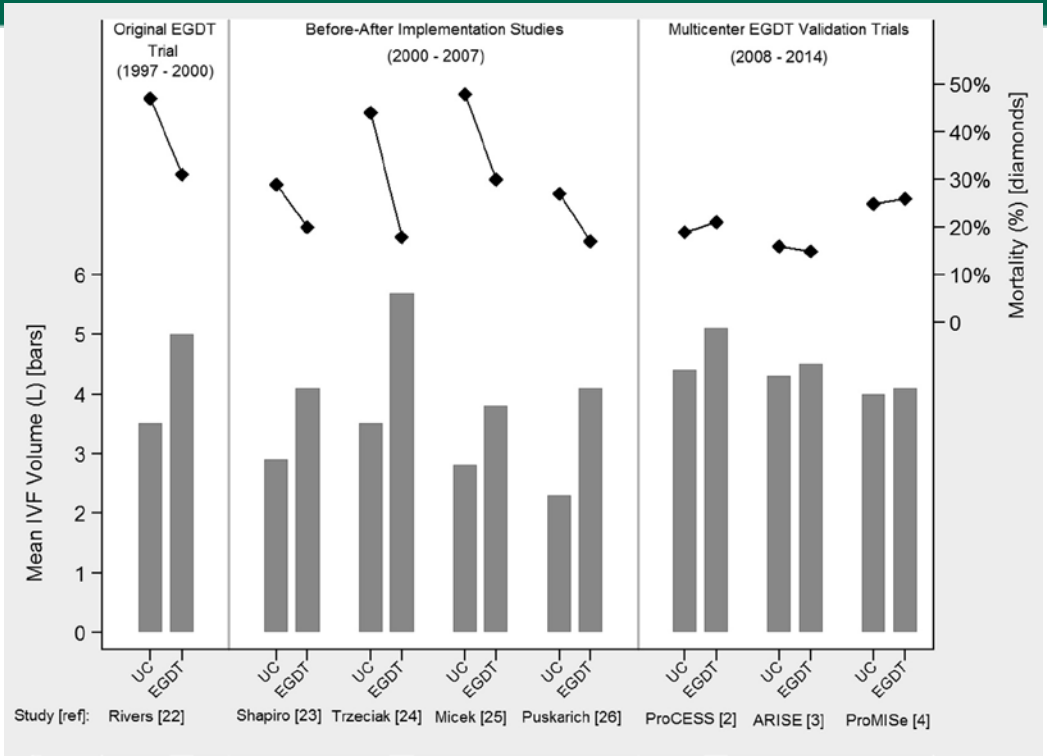
National Heart, Lung, and Blood Institute Prevention and Early Treatment of Acute Lung Injury Network (PETAL) Investigators

Crystalloid Liberal or Vasopressor Early Resuscitation in Sepsis trial **(CLOVERS)**

Review the current literature on approaches to early fluid resuscitation in adults with septic shock and outline the rationale for the upcoming trial.

American College of Emergency Physicians podcast for this article is available at www.annemergmed.com.
Ann Emerg Med. 2018;72:457-466.] https://doi.org/10.1016/j.annemergmed.2018.03.039

# Liberal Versus Restrictive Intravenous Fluid Therapy for Early Septic Shock

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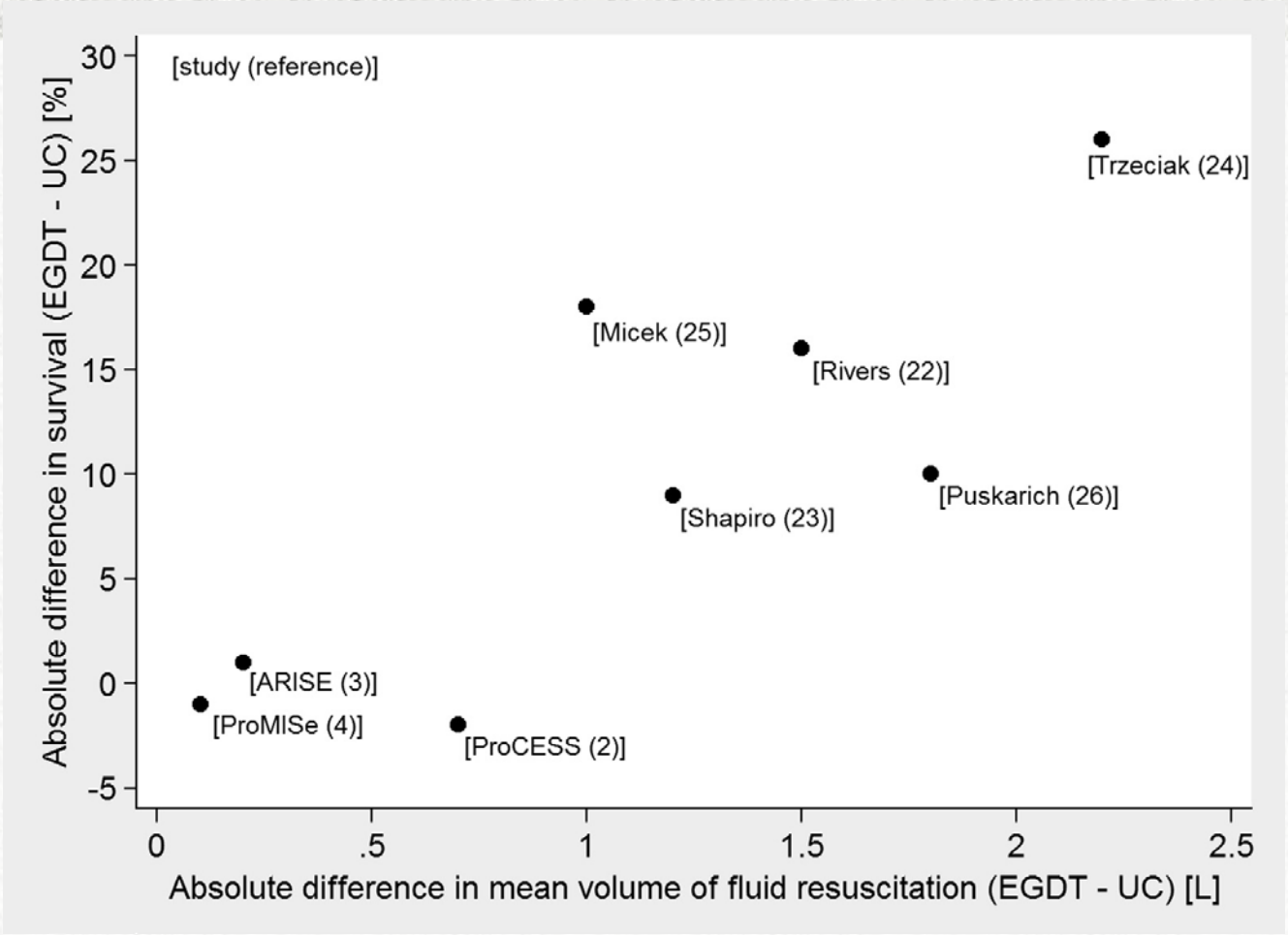

[study (reference)]
[Trzeciak (24)]
[Micek (25)]
[Rivers (22)]
[Puskarich (26)]
[Shapiro (23)]
[ARISE (3)]
[ProMISe (4)]
[ProCESS (2)]
Absolute difference in survival (EGDT - UC) [%]
30
25
20
15
10
5
0
-5
0
.5
1
1.5
2
2.5
Absolute difference in mean volume of fluid resuscitation (EGDT - UC) [L]

# Time to Treatment and Mortality During Mandated Emergency Care for Sepsis

- There is less evidence that the rate of bolus or completion within the time frame changes mortality

- Found no association between the time to completion of the initial bolus of intravenous fluids and outcome

June 8, 2017
N Engl J Med 2017; 376:2235-2244

# Recent Clinical Trials

- FEAST Trial – East Africa
  - Liberal boluses not beneficial pediatric
- CLASSIC Trial - Europe
  - Restrictive favorable
- Simplified Severe Sepsis Protocol Trial– Zambia
  - Larger initial fluid boluses detrimental
- RIFTS – USA
  - Restrictive decrease fluid balance with no negative affects
- ARISE FLUIDS – Australia
  - Observe practice fluids/vasopressors to inform recruitment for future trial

# Liberal Versus Restrictive Intravenous Fluid Therapy for Early Septic Shock: Rationale for a Randomized Trial

| |
|---|
| Prompt intravenous fluid therapy is a fundamental treatment for patients with septic shock. |
| Liberal fluids approach |
| Larger volume of initial fluid (50 to 75 mL/kg [4 to 6 L in an 80-kg adult] during the first 6 hours) |
| Later use of vasopressors |
| Early fluid therapy may enhance or maintain tissue perfusion by increasing venous return and cardiac output. |
| Fluid administration may also have deleterious effects by causing edema within vital organs, leading to organ dysfunction and impairment of oxygen delivery. |

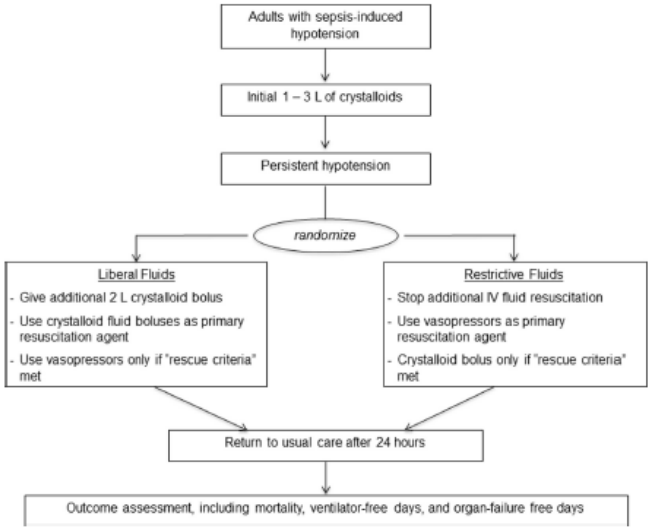
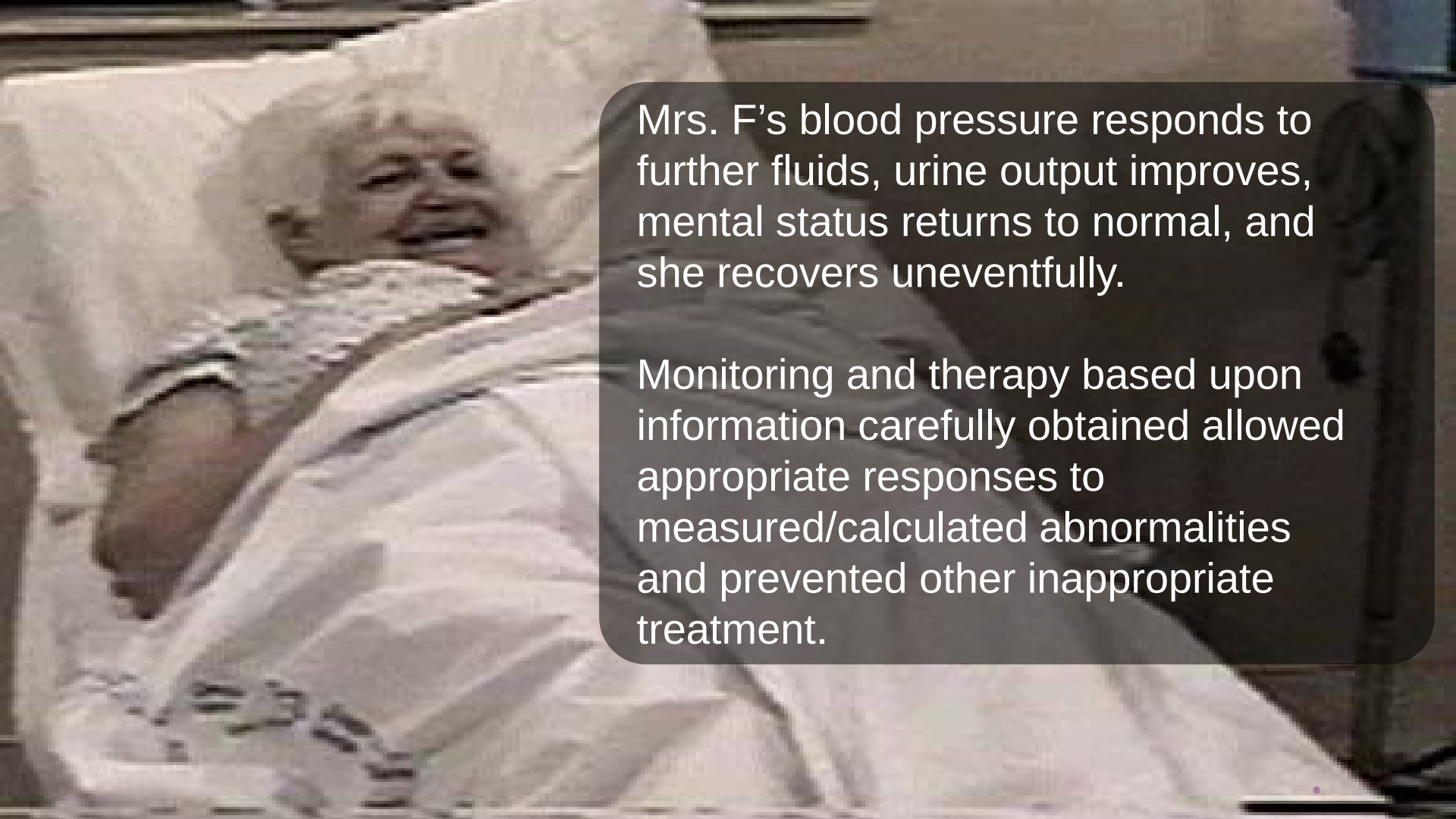



**Figure 3.** Trial design summary for the CLOVERS trial.

| |
|---|
| Optimal approach for administering intravenous fluid in septic shock resuscitation is unknown. |
| Restrictive fluids approach |
| Earlier reliance on vasopressor infusions to maintain blood pressure and perfusion. |
| Smaller volume of initial fluid (≤30 mL/kg [≤2 to 3 L]) |
| Restrictive fluids approach primarily relies on vasopressors to reverse hypotension and maintain perfusion while limiting the administration of fluid. |
| Both strategies have some evidence to support their use but lack robust data to confirm the benefit of one strategy over the other, creating clinical and scientific equipoise |

American College of Emergency Physicians podcast for this article is available at www.annemergmed.com.
Ann Emerg Med. 2018;72:457-466.] https://doi.org/10.1016/j.annemergmed.2018.03.039



Mrs. F’s blood pressure responds to further fluids, urine output improves, mental status returns to normal, and she recovers uneventfully.

Monitoring and therapy based upon information carefully obtained allowed appropriate responses to measured/calculated abnormalities and prevented other inappropriate treatment.

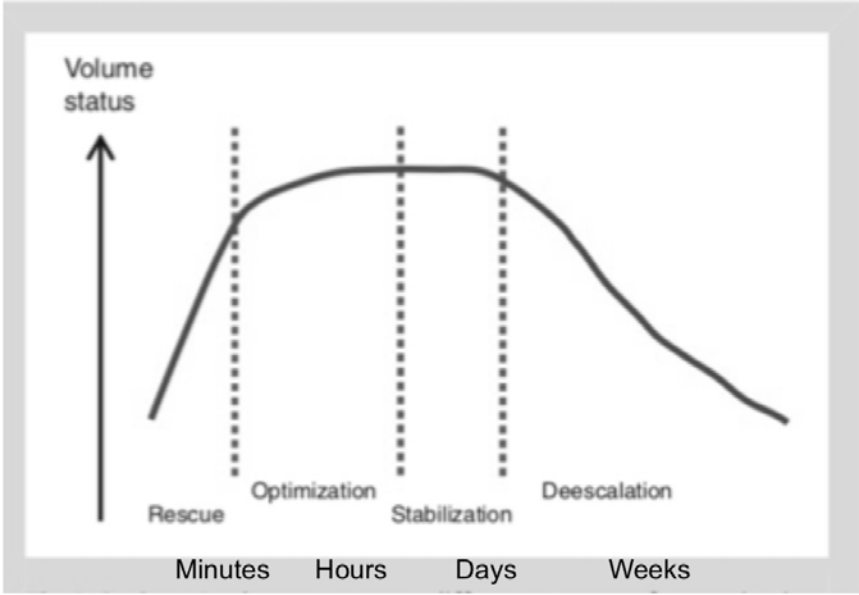
British Journal of Anaesthesia 113 (5): 740–7 (2014)
Advance Access publication 9 September 2014 · doi:10.1093/bja/aeu300

BJA

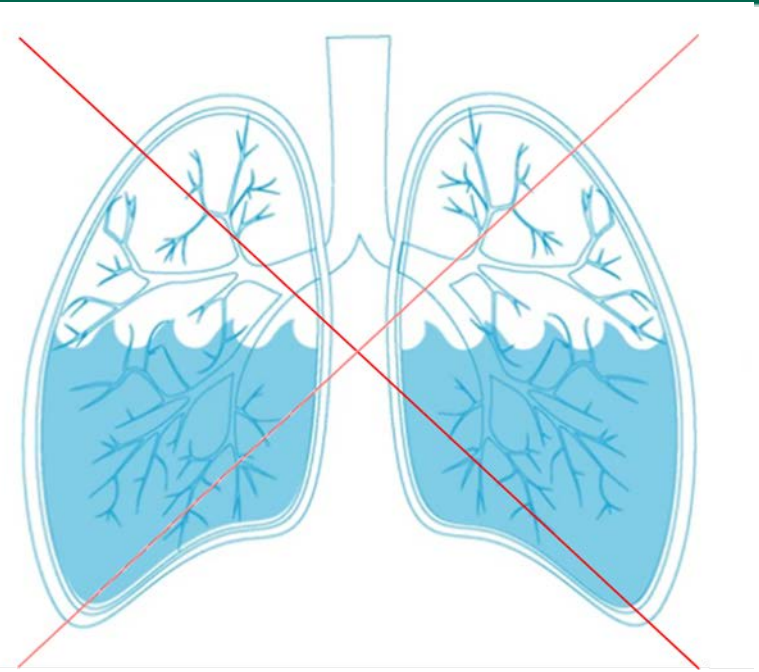
SPECIAL ARTICLES

# Four phases of intravenous fluid therapy: a conceptual model†

E. A. Hoste[1,2], K. Maitland[3,4], C. S. Brudney[5], R. Mehta[6], J.-L. Vincent[7], D. Yates[8], J. A. Kellum[9], M. G. Mythen[10] and A. D. Shaw[11] for the ADQI XII Investigators Group



# Deresuscitation



In ARDS, sepsis or SIRS, a conservative or de-resuscitative fluid strategy results in an increased number of ventilator-free days and a decreased length of ICU stay compared with a liberal strategy or standard care

Intensive Care Med. 2017 Feb;43(2):155-170
**Conservative fluid management or deresuscitation for patients with sepsis or acute respiratory distress syndrome following the resuscitation phase of critical illness: a systematic review and meta-analysis.**
Silversides JA, Major E, Ferguson AJ, Mann EE, McAuley DF, Marshall JC, Blackwood B, Fan E.

# Fluid management and deresuscitation practices: A survey of critical care physicians

Jonathan A Silversides[1,2], Daniel F McAuley[1,2], Bronagh Blackwood[1], Eddy Fan[3], Andrew J Ferguson[1,2] and John C Marshall[3,4]

Journal of the Intensive Care Society
0(0) 1–8

DOI: 10.1177/1751143719846442
journals.sagepub.com/home/jics
SAGE

**Table 1.** Broadly speaking, how do you perceive the issue of fluid overload (positive fluid balance with oedema) in ICU patients? (N = 367).

| | Strongly agree | | Agree | | Uncertain/neither agree nor disagree | | Disagree | | Strongly disagree | | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | N | % | N | % | N | % | N | % | N | % | N |
| An inevitable consequence of appropriate fluid resuscitation in the presence of capillary leak | 84 | (23.1%) | 186 | (51.2%) | 45 | (12.4%) | 43 | (11.9%) | 5 | (1.4%) | 363 |
| A modifiable consequence of fluid administration from multiple sources | 75 | (20.6%) | 234 | (64.3%) | 42 | (11.5%) | 12 | (3.3%) | 1 | (0.3%) | 364 |
| A manifestation of sodium and water retention due to endocrine factors and acute kidney injury | 29 | (8.0%) | 217 | (59.6%) | 78 | (21.4%) | 36 | (9.9%) | 4 | (1.1%) | 364 |
| An issue which will resolve spontaneously with resolution of the underlying illness | 30 | (8.3%) | 136 | (37.8%) | 91 | (25.3%) | 90 | (25.0%) | 13 | (3.6%) | 360 |
| A finding without clinical consequence | 3 | (0.8%) | 9 | (2.5%) | 24 | (6.7%) | 139 | (38.5%) | 186 | (51.5%) | 361 |
| A modifiable source of morbidity | 129 | (35.5%) | 180 | (49.6%) | 38 | (10.5%) | 11 | (3.0%) | 5 | (1.4%) | 363 |

*A 56 year-old man was ad*
*bronchodilators, and hype*
*On morning rounds, he re*
*pressure 100/55 mmHg (M*
*110 µmol/l (1.2mg/dL), ar*
*14.8 x10^9/L.*
*He is diffusely edematous,*
*enteral feed, and 50 mls/h*

*PD for which he is using*

*heart rate is 105 bpm, blood*
*actate 1.6 mmol/l. His creatinine is*
*de overnight, and his WBC count is*

*is currently receiving 30 mls/hour*

Administer a diuretic with the aim of achieving a negative fluid balance.

Administer a fluid bolus with the goal of reducing heart rate, increasing MAP, and/or reducing pressor requirements.

Use renal replacement therapy with the aim of achieving a negative fluid balance

Discontinue maintenance IV fluid.

Continue without changes to fluid management

*A 61 year-old female was involved in a motor vehicle collision. She was initially admitted to a peripheral hospita* *acked red cells in the emergency depart* *ectomy. Her other injuries include fra* *l a mid-shaft fracture of the righ*

*Following transfer* *nically ventilated with an FiO2 of 0.* *edematous. The intra-abdominal p* *timuli. Her heart rate is 85 bpm and* *nd dynamic indices do not suggest flui* *, urea is 17 mmol/L, potassium 4.0 mm* *e has been in a positive fluid balar* *what you consider to be a high dose of diuretics.*

- Administer a diuretic with the aim of achieving a negative fluid balance.
- Administer a fluid bolus with the goal of reducing heart rate, increasing MAP, and/or reducing pressor requirements.
- Use renal replacement therapy with the aim of achieving a negative fluid balance
- Discontinue maintenance IV fluid.
- Continue without changes to fluid management

# SUMMARY - It's not Easy!

Hemodynamic management and fluid balance in resuscitation cases are constant day to day challenges.

The holy grail for end points resuscitation continues to elude us.

# Eduardo Martinez Case

62 y.o. female brought by family to the ED with history of syncope at home. She states she has felt a dull full feeling in her left lower abdomen for 4 days, and this morning had 3 bloody bowel movements, leaving her feeling weak and dizzy. She has taken nothing by mouth except sips of tea today.

- PMHX- hypertension managed with metoprolol, diet controlled DM with a hgba1c 7.1 three months ago and a BMI of 36, breast cancer this year post-mastectomy and last chemotherapy 4 weeks ago
- Allergy- penicillin (rash after taking it for a few days 30 years ago for a dental procedure)

- VS – BP 100/60, HR 98, R 22, and O2 sat 100% on room air, T 99.4 F (standing BP 90/51, HR 110)
- Pale conjunctiva
- Abdomen- palpable discomfort left lower quadrant, no rebound or guarding
- Rectal normal exam except noted blood on glove
- Extremities warm with easily palpable pulses

- Chest X-ray – normal findings with chemo port in good position
- EKG- sinus tachycardia, nonspecific lateral ST changes and high lateral R waves in AVL, V5, V6 consistent with LVH
- Troponin 2.1
- Lab calls with a critical hemoglobin 6.2

- Labs- glucose 195, creatinine 1.5, BUN 47, hgb 6.5, WBC 3.5
- Despite IVF and blood transfusion, her BP deteriorates to 88/50, repeat hgb 8.5 after 2 units PRBC.
- Her urine output remains low at 30ml/hr.
- Bedside echocardiogram reports EF 30% globally depressed with LVH

- Rapid micro results with positive gene expression for MRSA in blood cultures done in triage and E. coli 2/2
- CT abdomen and pelvis- some thickening of the sigmoid colon wall, with possible small adjacent collection