

Early Burn Management

Michael Feldman, M.D.
Medical director,
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Dr. Mack Drake

- Valedictorian and Class President in high school
- Doctor of Osteopathic medicine from Pikeville College SOOM
- Internship at Vanderbilt University MC
- Residency at Carilion SOM
- Burn Fellowship Emory
- Trauma and Critical Care Fellowship Univ of Kentucky



Learning Objectives

- Review the history of burn injuries and VCU
- Understand trends in burn mortality
- Understand burn resuscitation and how it differs from other traumatic injuries
- Understand the difference between escharotomies and fasciotomies
- Review guidelines for inhalation injury and airway observation
- Review Pediatric burn resuscitation and differences with Adult resuscitation

Cocoanut Grove Fire

- 1000 people in a night club designed to hold 400
- 492 dead and 166 injured
- Massive change in burn care
 - Building code regulations
 - Fluid resuscitation
 - Burn size calculation
 - Recognition of inhalation injury



Dr. Everret I. Evans

- Created the first civilian burn center in the United States
- Burn Director from 1947 - 1954
- Burn Resuscitation
- Pioneer in the evaluation of radiation skin injury



Dr. B.W. Haynes Jr.

- Internship at the Medical College of Virginia
- Completed his residency in General Surgery in 1948 at MCV
- Associate Professor of Surgery at Baylor 1949
- Returned to MCV in 1953 as a Major in the Medical Corp of the U.S. Army
- Research related to burn metabolism
- Second president of the American Burn Association
- Created the trauma system at MCV
- Burn Director at MCV for 36 years

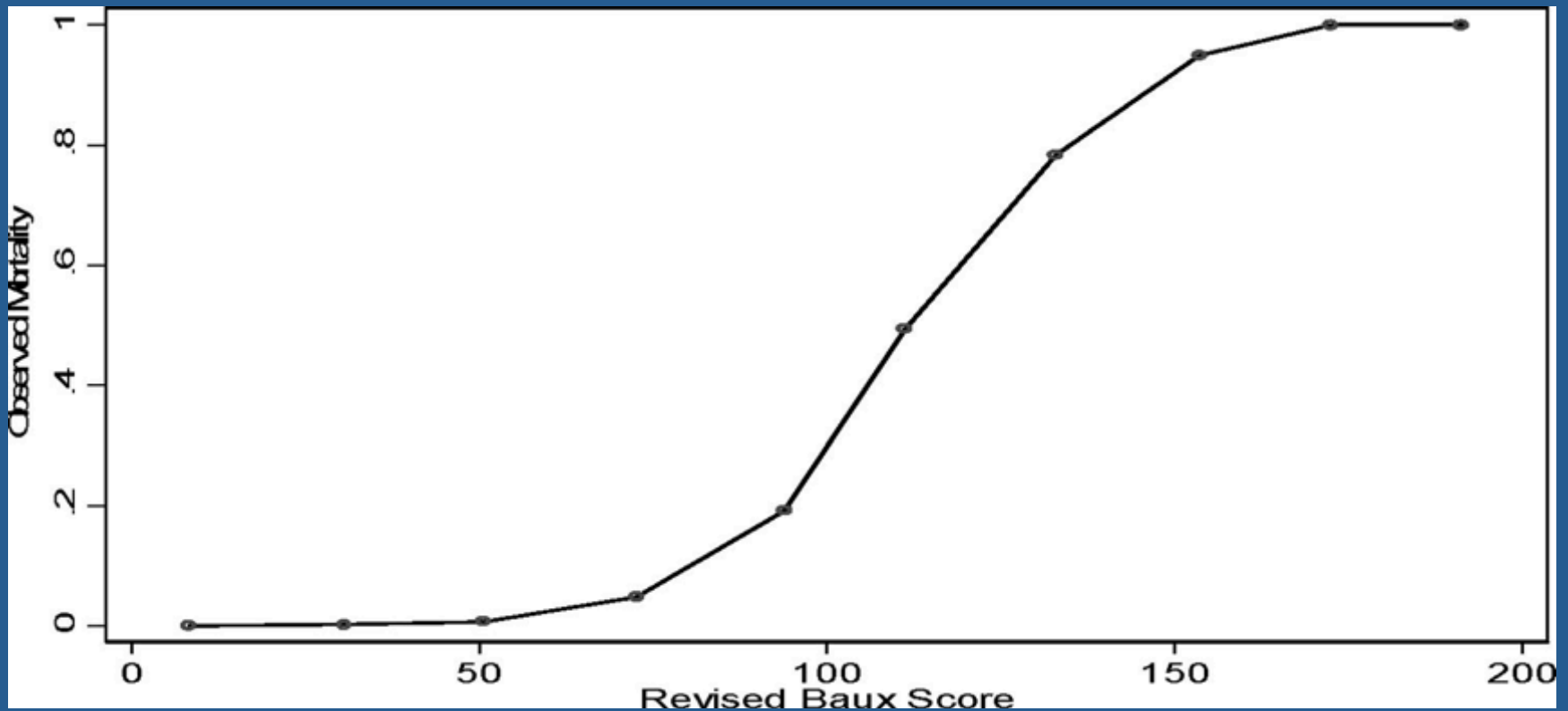


Burn Mortality

- Baux formula
 - Mortality = Age + Total Body Surface Area

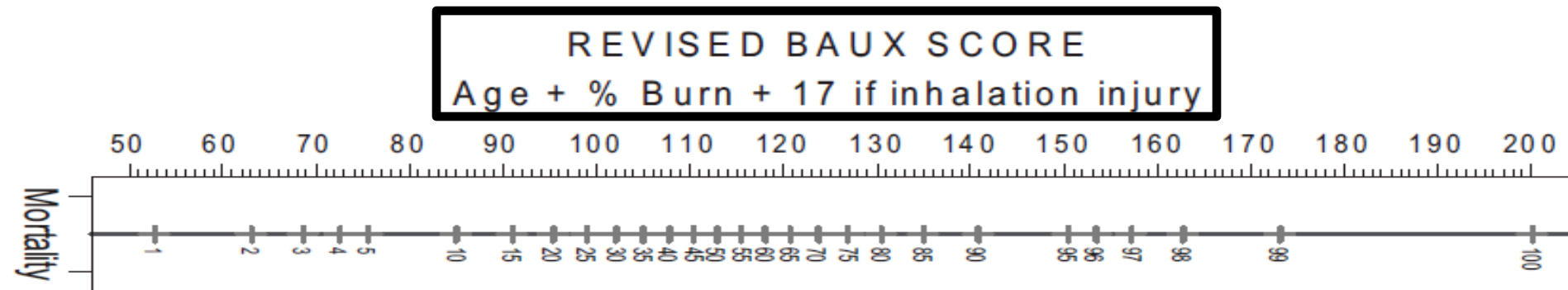


Modern burn mortality



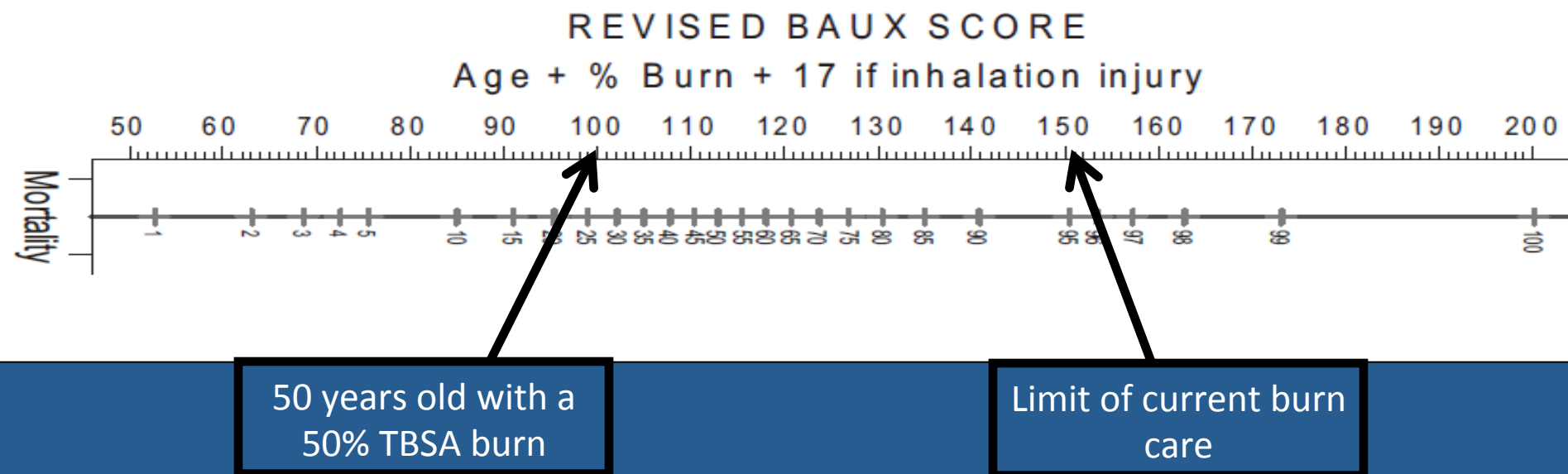
Osler T, Glance LG, Hosmer DW. Simplified estimates of the probability of death after burn injuries: extending and updating the Baux score. J Trauma. 2010 Mar; 68(3): 690 – 7.

Revised Baux Score



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Burn Resuscitation

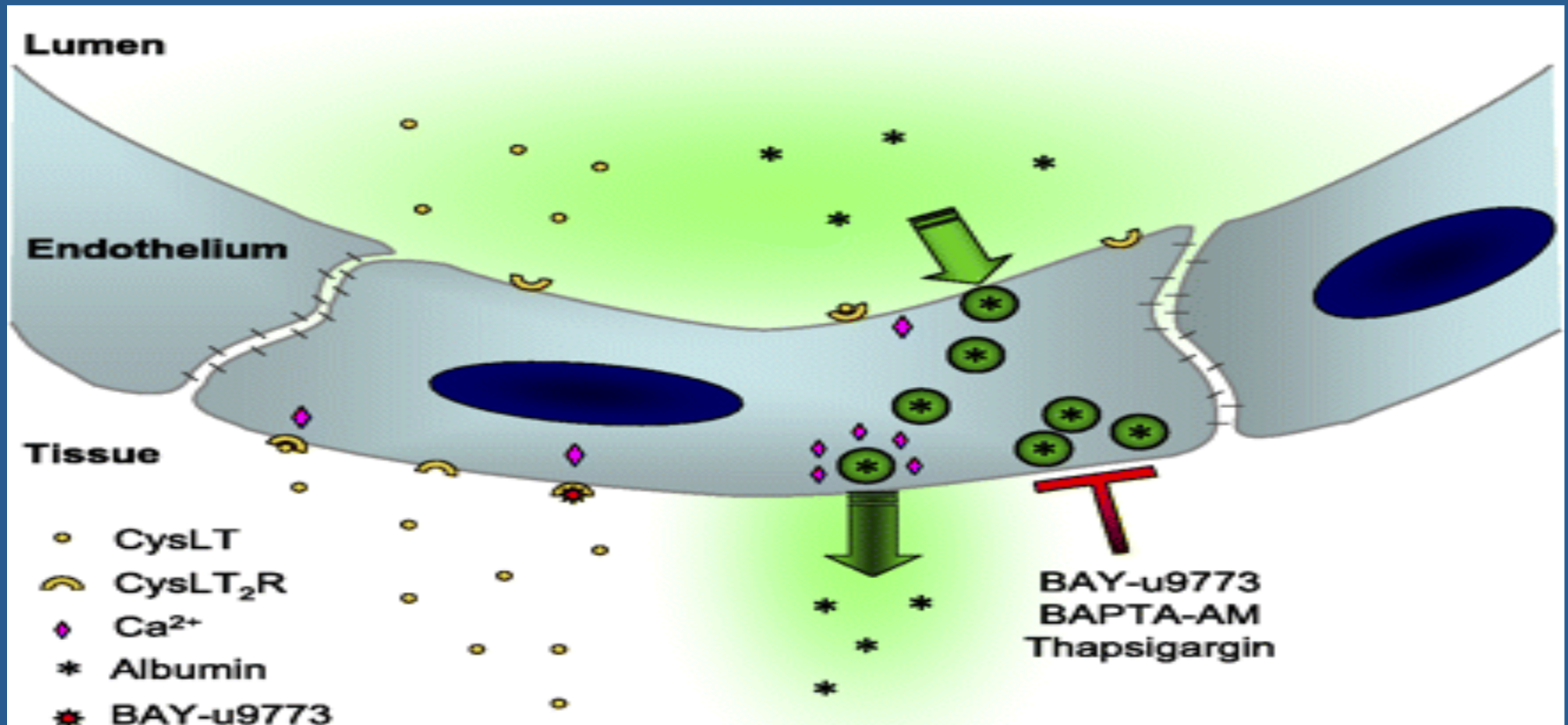
- **Baxter (Parkland)**
 - 4 mL/Kg/% TBSA for 24 hours, then **plasma** 0.5 mL/Kg/% TBSA + D5W for the second 24 hours
- **Evan's formula**
 - NS 1 mL/Kg/% TBSA + **colloids** 1 mL/Kg/% TBSA + 2000 mL D5W
- **Brook army formula**
 - **Colloid** 2 mL/Kg/% TBSA, later modified to LR + 0.5 mL/Kg/% TBSA

SAFE Trial

- 6997 patients randomly assigned to receive albumin versus saline resuscitation
- Number of deaths, multi-organ failure, days in the ICU, days in the hospital, days on mechanical ventilation all similar
- Early trends showed less fluid requirement in the albumin group but higher blood product usage

Mediators of Increased Vascularity

Cysteinyl Leukotrienes



Fluid Creep

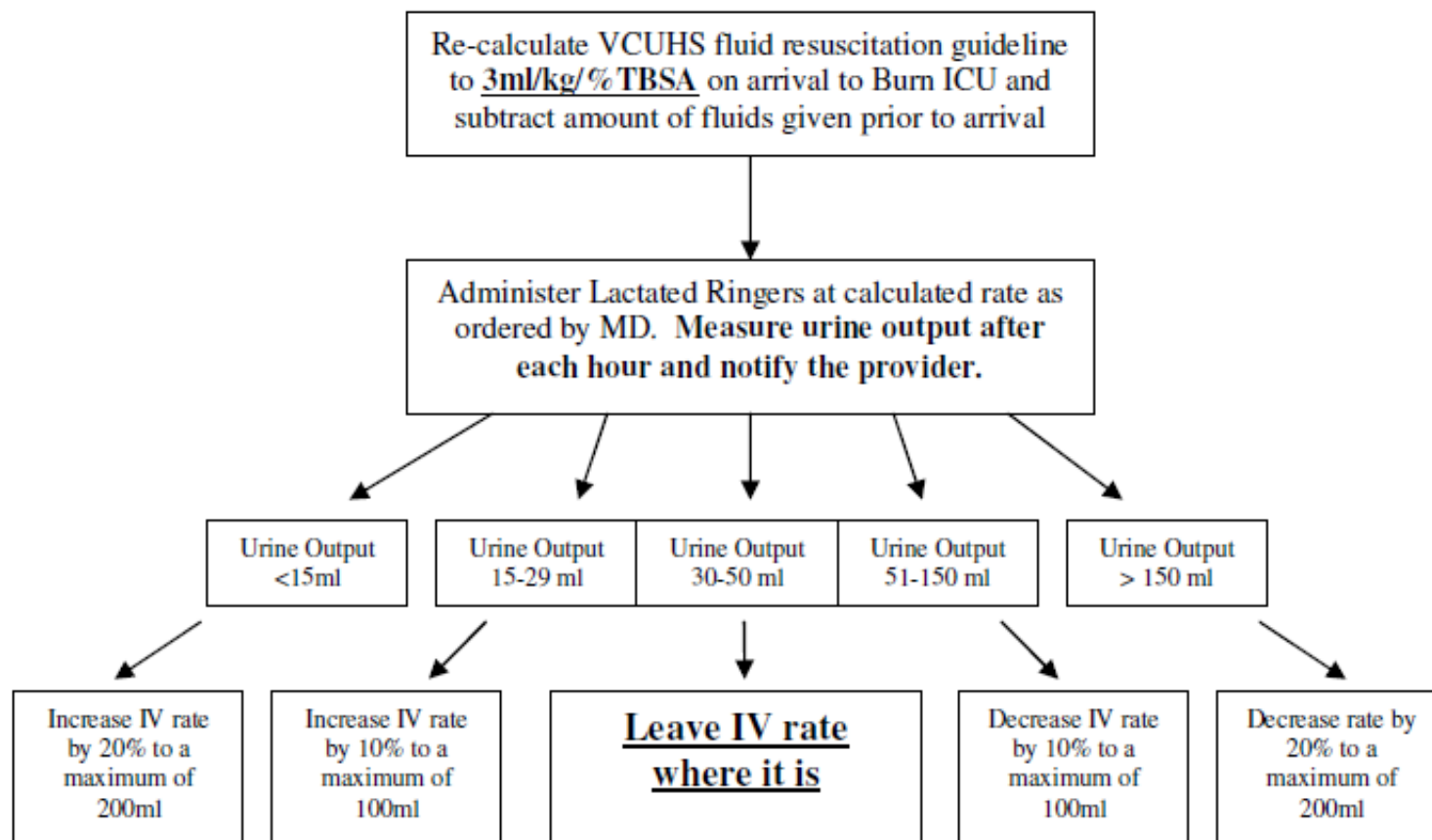
- Over-resuscitation
- Reluctance to reduce fluids
- Liberal use of opioids
- Use of goal-directed resuscitation

Potential result of fluid creep



VCUHS Adult Fluid Resuscitation Guideline FOR BURNS 20%TBSA AND GREATER

**NOTIFY PROVIDER HOURLY OF URINE OUTPUT AND
HEMODYNAMIC STATUS, TITRATE PER GUIDELINE.**



EVENTS THAT SHOULD HAPPEN AT HOUR EIGHT:

1. FLUID RATE SHOULD BE HALVED IF URINE OUTPUT IS ADEQUATE OR EXCESSIVE
2. PATIENTS WITH PERSISTENT (2 CONSECUTIVE HOURS OR MORE) LOW URINE OUTPUT DESPITE TITRATION SHOULD BE EVALUATED FOR ALBUMIN PROTOCOL

VCUHS Adult Fluid Resuscitation Guideline FOR BURNS 20%TBSA AND GREATER

**NOTIFY PROVIDER HOURLY OF URINE OUTPUT AND
HEMODYNAMIC STATUS, TITRATE PER GUIDELINE.**

Re-calculate VCUHS fluid resuscitation guideline
to 3ml/kg/%TBSA on arrival to Burn ICU and
subtract amount of fluids given prior to arrival

Administer Lactated Ringers at calculated rate as
ordered by MD. Measure urine output after
each hour and notify the provider.

Urine Output
<15ml

Urine Output
15-29 ml

Urine Output
30-50 ml

Urine Output
51-150 ml

Urine Output
> 150 ml

Increase IV rate
by 20% to a
maximum of
200ml

Increase IV rate
by 10% to a
maximum of
100ml

**Leave IV rate
where it is**

Decrease IV rate
by 10% to a
maximum of
100ml

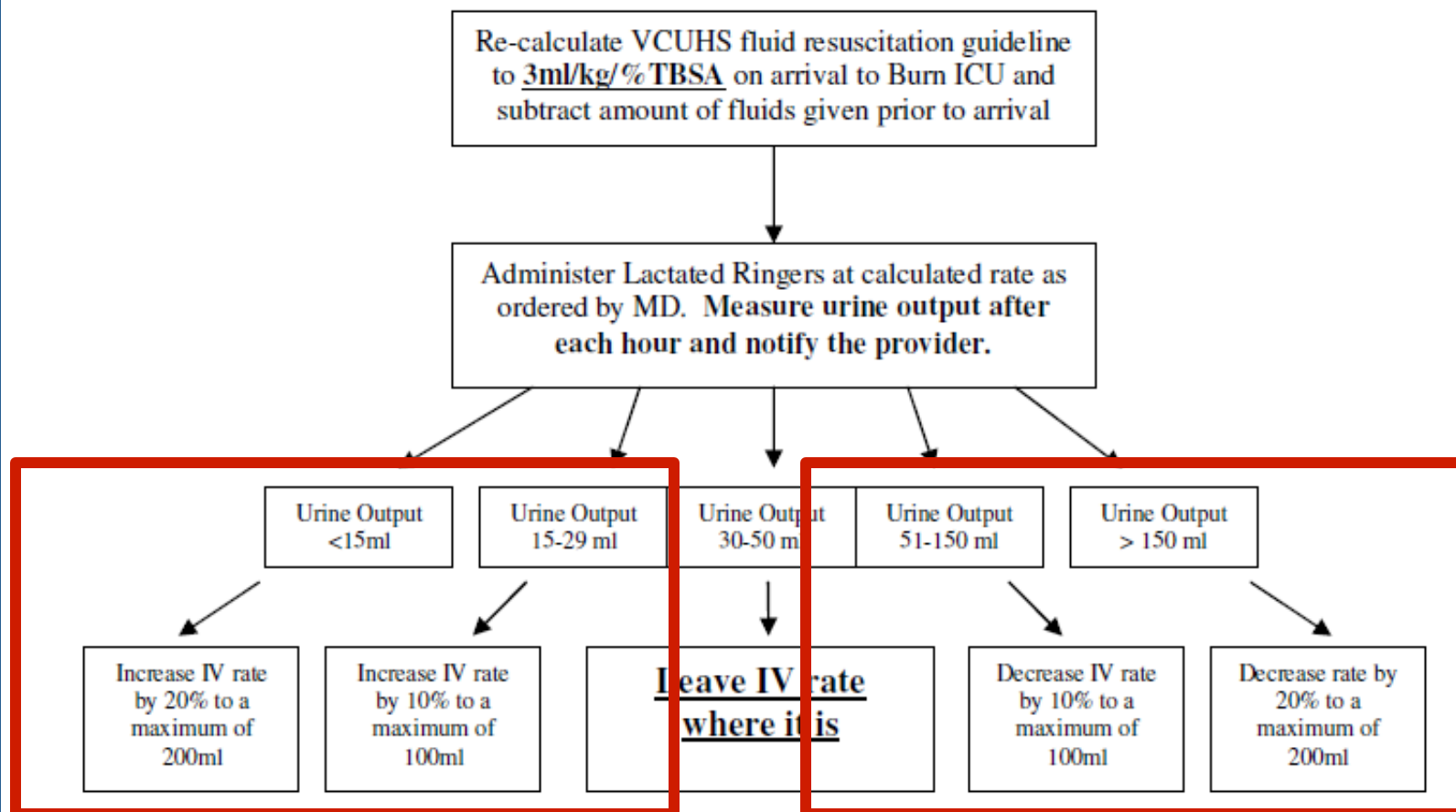
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Rescue Protocol

- Approach to patients who don't respond
 - Rule out trauma
 - Start albumin drip (1 mL/Kg is converted to 5% albumin and subtracted from the total crystalloid rate)
 - Consider early dialysis
 - Check bladder pressure every four hours
 - Early excision...

Future of resuscitation

- High-dose Vitamin C
- Plasmaphoresis
- Exchange transfusion
- Computer-based fluid titration
- Computer-based surface area calculation
- Oral fluid resuscitation

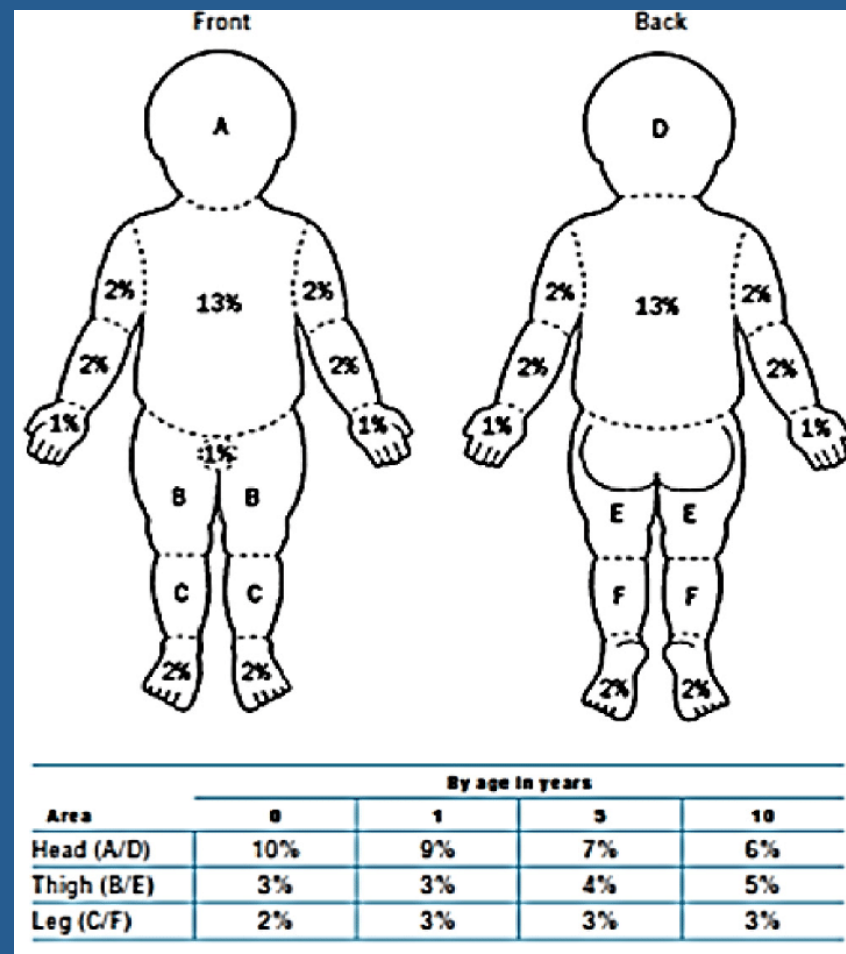
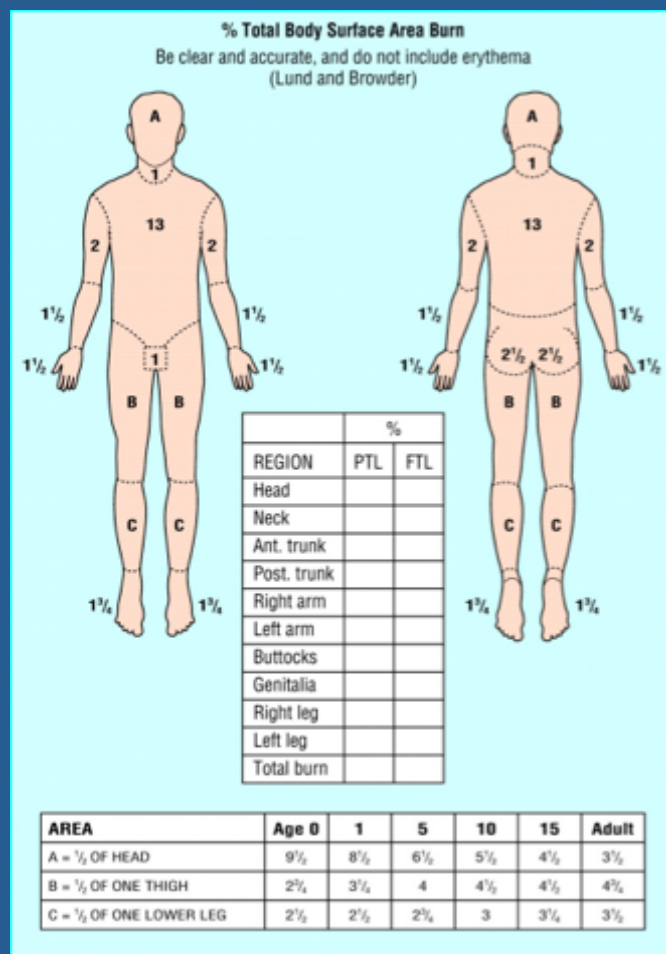
Total Body Surface Area Calculation

1. Rule of Palms
 2. Rule of Nines
 3. Lund and Browder Chart
 4. SAGE diagram
- A. The most accurate method for burn size calculation
 - B. Useful in smaller burns
 - C. Electronic resource
 - D. Helpful for calculating TBSA for larger burns

Total Body Surface Area Calculation

- | | |
|---------------------------|---|
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| 4. SAGE diagram | 4. Electronic resource |

Lund and Browder Diagram



60 y/o Female caught her clothing on fire while smoking



Discuss the TBSA and best method to preserve distal blood flow



Eshcarotomies

- Why
- When
- How
- Where
 - What part of the hospital is appropriate
 - Anatomic location

Escharotomy incisions



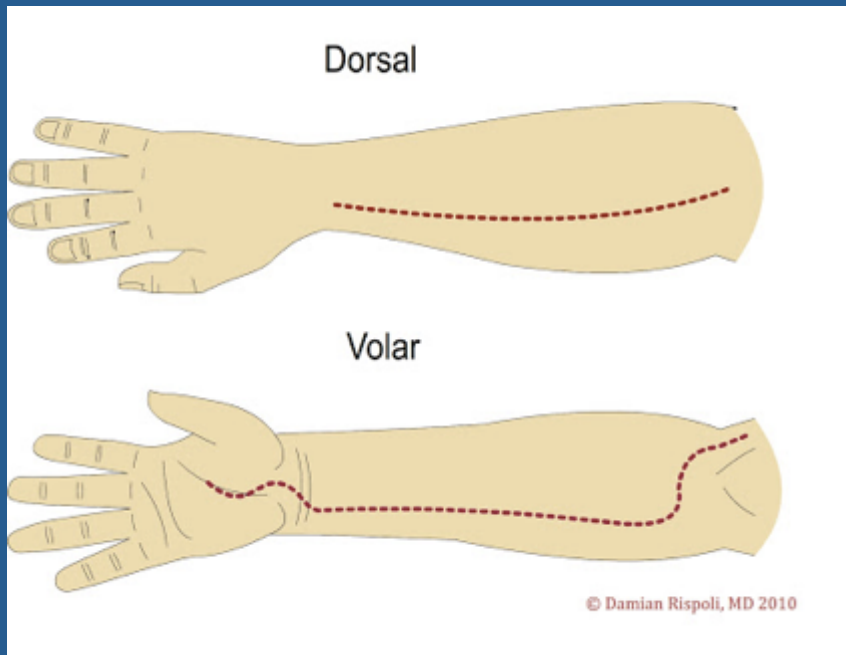
Fig. 31.3 Expanded schematic representation of escharotomies of the forearm and hand



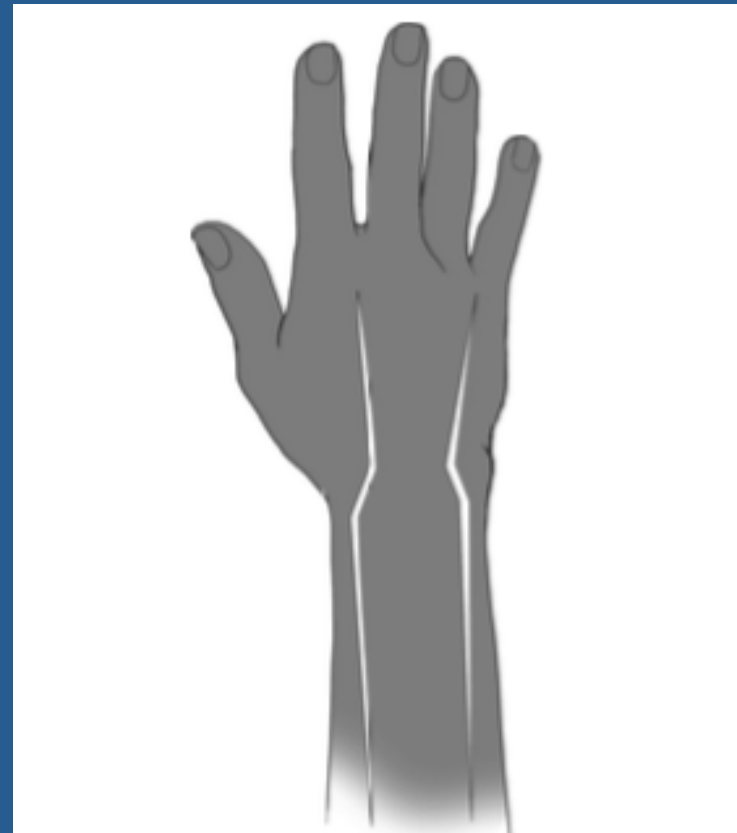
Fig. 31.2 Schematic representation of escharotomies of the trunk, lower limb, upper limb, and hand

Different incision sites

Fasciotomy



Escharotomy



Lower extremity escharotomy incisions



24 y/o Male pilot of a small plane that crashed



2 y/o Female intubated in the Pediatric ED



Pediatric Burn Resuscitation

Urine
Output

```
graph TD; A[Urine Output] --> B["<1 mL/Kg/Hr"]; A --> C["1 mL/Kg/Hr"]; A --> D[">>1 mL/Kg/Hr"]; B --> E["Increase LR by 10%"]; C --> F["LR rate stays the same"]; D --> G["Decrease LR by 10%"];
```

The diagram is a flowchart titled 'Urine Output' at the top. It branches into three categories: '<1 mL/Kg/Hr' (red box), '1 mL/Kg/Hr' (yellow box), and '>1 mL/Kg/Hr' (green box). Each category leads to a specific instruction: 'Increase LR by 10%' for the first, 'LR rate stays the same' for the second, and 'Decrease LR by 10%' for the third.

<1 mL/Kg/Hr

Increase LR
by 10%

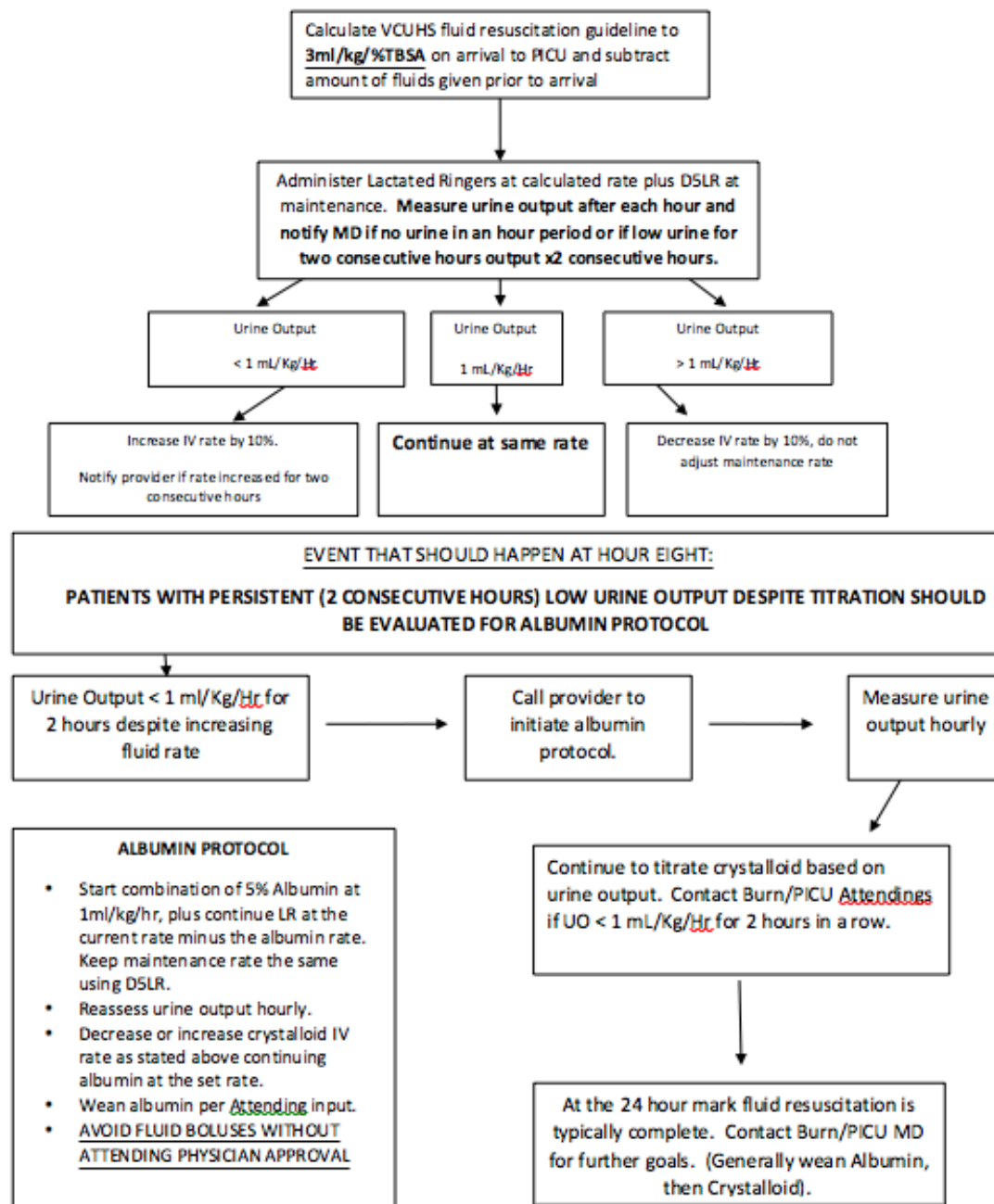
1 mL/Kg/Hr

LR rate stays
the same

>1 mL/Kg/Hr

Decrease LR
by 10%

Resuscitation Algorithm



Inhalation injury versus Airway protocol

- All patients with appropriate mechanism are considered for either protocol
 - Smoke exposure
 - Enclosed area
- All of these patients should be scoped
- Negative scope, normal labs, asymptomatic patient goes on airway protocol
 - ICU **or Stepdown**, NPO with IVF for 24 hours from exposure

Inhalation injury versus Airway protocol

- Inhalation injury protocol
 - Positive scope – strongly consider intubation, ICU, nebulized meds and 100% FiO₂ x 6 hours
 - Symptomatic with negative scope – ICU, nebulized meds and 100% FiO₂ x 6 hours
 - Those in the inhalation injury protocol should go to ICU!
 - **UPDATE: Asymptomatic with negative scope – don't need meds but need close observation and NPO status (can be either ICU or Stepdown)**
- Inhalation injury protocol timing:
 - 100% FiO₂ for 6 hours from when the oxygen is started
 - Nebulized meds alternate heparin, albuterol and mucomyst every 4 hours for 7 days or stop earlier if extubated
 - NPO with IVF, may start post-pyloric tube feeds

48 y/o Male with prolonged exposure to smoke from Housefire



2 y/o Female with scald burn



QUESTIONS

Question

- 40 y/o Male driver with 40% burn and MVC T-boned on driver's side. Arrives 30 minutes from the injury hypotensive. Has two peripheral IV's and received 5 liters of fluid. Has received Cyanokit. What is the cause of the hyotension.
- A. the burn of course
- B. inadequate burn resuscitation
- C. undiagnosed traumatic injury
- D. untreated inhalation injury

Question

- 45 y/o Female with scald burns to both feet from soaking them in epsom salt for 30 minutes. Presents through ED. Burn wounds are red, non-blanching. No palpable pulses. The next appropriate step is:
 - A. Escharotomies
 - B. Admission and Vascular workup, high likelihood for surgical intervention
 - C. Amputation
 - D. Discharge and manage outpatient
 - E. Complex fluid resuscitation

Question

- 5 y/o Female pulls down pot of hot water onto herself. Presents with family to pediatric ED. 10% TBSA burns include face and chest. The next appropriate step is:
- A. Admit to EHBC for wound care
- B. Have social worker clear then discharge home
- C. Establish IV access and admit to PICU for fluid resuscitation
- D. Intubate due to concern for inhalation injury

Question

- 2 y/o Male pulls hot water onto himself. Presents with 30% TBSA burns.
- A. Admit to floor status for wound care and pain control
- B. Place a foley, start fluid resuscitation with goal urine output of 30 – 50 mL/Kg/hr
- C. Avoid foley, start fluid resuscitation with goal urine output of 0.5 mL/kg/hr
- D. Place a foley, start fluid resuscitation with goal urine output of 1 mL/kg/hr

Question

- 40 year old Male on low carb diet, climbs stairs daily. Presents to trauma bay with circumferential burn to right arm intubated and sedated and recently paralyzed. Compartments are tight and the hand is cool but pulses are present.
- A. Immediate fasciotomy
- B. Wait until pulse is lost then go to OR
- C. Check compartment pressures
- D. Immediate escharotomy

Question

- 90 y/o Male with 50% TBSA burn and inhalation injury arrives to trauma bay. PMH metastatic cancer.
- A. Updated Baux score is < 150
- B. Prep for intubation and escharotomies
- C. Start resuscitation at 3 mL/Kg/TBSA, adjusting fluid based on urine output
- D. Involve patient, family, palliative and burn attending in goals of care discussion

Question

- When should you escalate?
 - A. hypotension
 - B. pediatric burn consult
 - C. patient needs to be admitted
 - D. operative burn wound
 - E. infection
 - F. airway issue
 - G. instability during resuscitation
 - H. poor urine output two hours in a row during resuscitation
 - I. I don't know what to do

Refer to the Burn Survival Guide and Burn Resident Manual

Front

Burn Survival Guide

The below orders or information are required for all new burn patients

- Admission and Discharge pictures (See Back)
- MRSA screens
- DVT prophylaxis: either SCDs or chemoprophylaxis, ask Burn Attending
- Physical and Occupational Therapy orders
- Burn Diagram: Lund and Browder chart \leq 24 hours
- Burn Admission or Consult Note
- For patients with burns $>$ or equal to 20% TBSA, they require tube feed access and initiation of tube feeds within 24 hours of admission (if not contraindicated)
- For all burn patients use adult and pediatric care sets under power plans

Back

Admission and Discharge Picture Guidelines

Send all pictures to the following

- Kathryn.michura@vcuhealth.org
- Barbara.birmingham@vcuhealth.org

Include the following on emails for each photo.

- Patient name
- Medical record number
- Date photo was taken
- Location of wound
-

For all burn admissions

- Admission pictures sent to Burn Program Manager and administrator via VCU email
- Lund and Browder diagram within 24 hours
- MRSA screen
 - Please use Burn Careset (Adult or Pediatric)
- DVT prophylaxis
 - Either chemoprophylaxis or mechanical
 - If Lovenox, then twice daily dosing
- Avoid routine antibiotic use
 - Try to avoid combination of Vanc and Zosyn