KBC:
AN ALL-BLOOD ANSWER TO DEL NIDO IN ADULTS

CSCP National Meeting 2017

- Background – Catherine Lunsford, CCP
- Method and Communication – Candice Kalin, CCP
- Surgeon’s perspective – Dr. William Cooper, MD, MBA


310
WELLSTAR
Kennestone
REGIONAL MEDICAL CENTER
Emergency
Main Entrance
Hospital Parking

Disclosures

- Speaker's Bureau: Quest Medical
- Consultant: Quest Medical
- Intellectual Property Interests

del Nido

- ✓ Originated in pediatrics
- ✓ Single-Dose Technique
- ✓ 1 part blood: 4 parts crystalloid
- ✓ Potassium, Lidocaine, Magnesium Sulfate, Mannitol, and Sodium Bicarbonate

Pediatric vs. Adult Heart

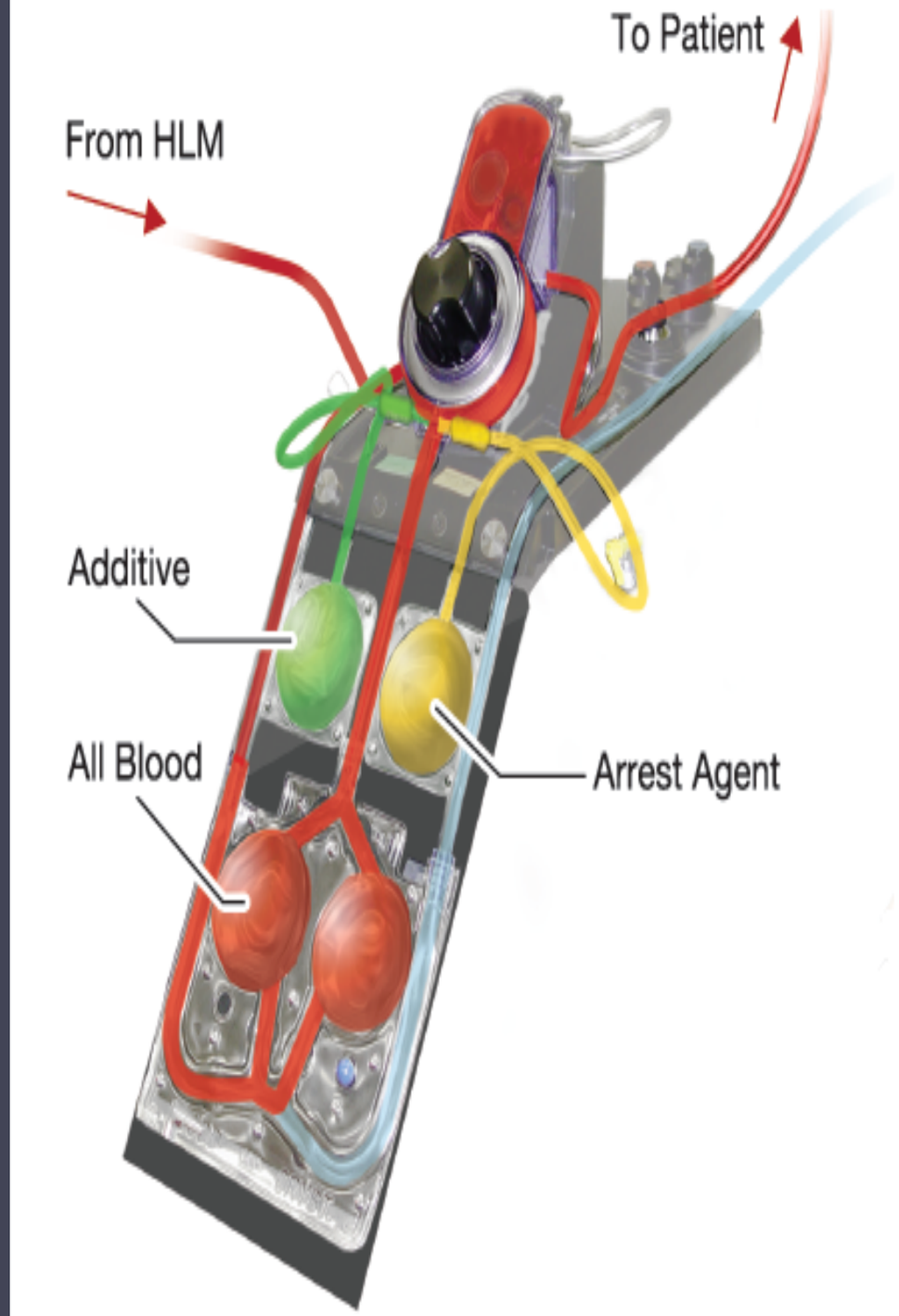
Single-dose for the Adult Heart

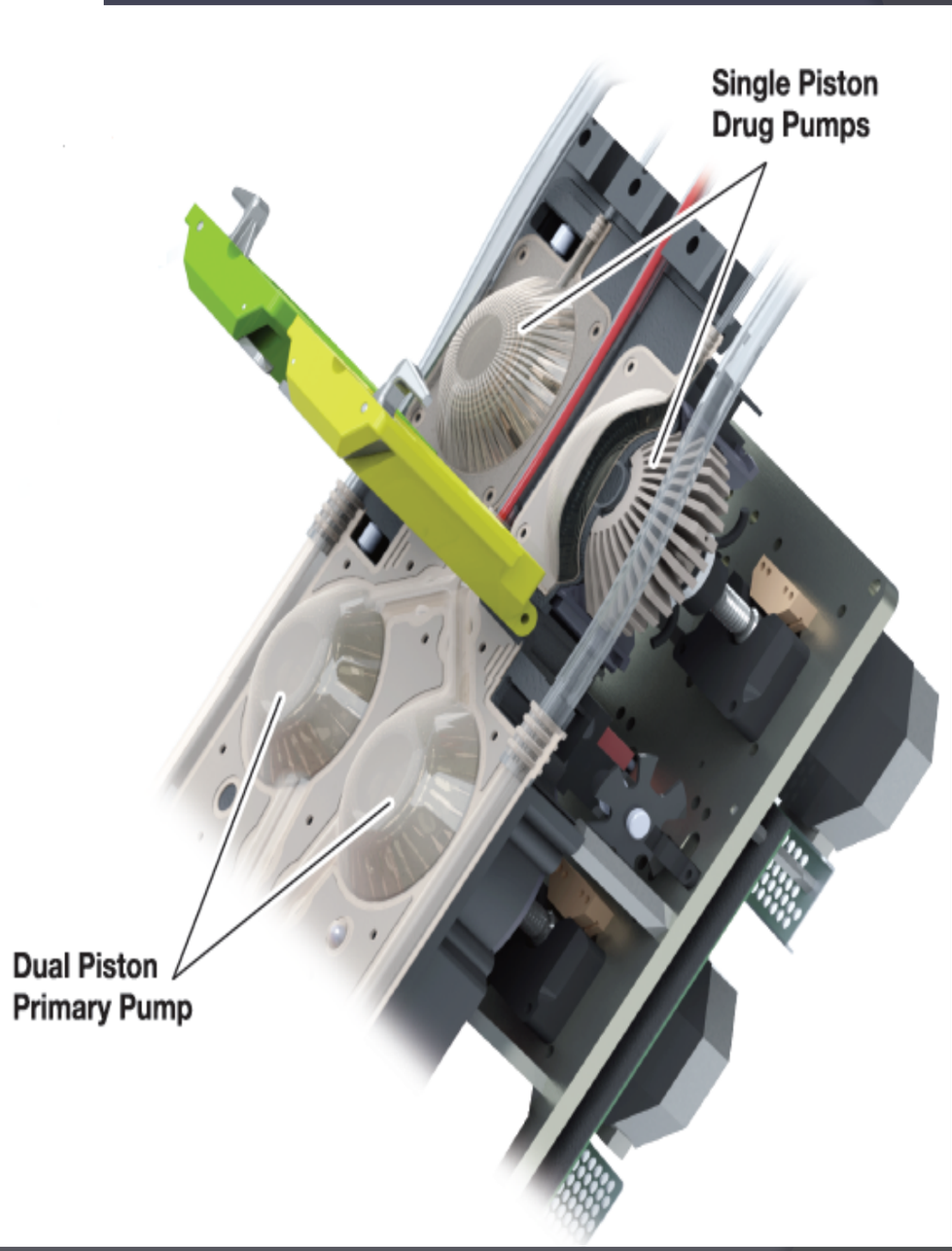
- Is it appropriate for all cases?
- Can we customize the method*?*
- Do we really need the crystalloid?

PROTECTING LIFE WITH SCIENCE

Accommodating patient needs with precision

QMPS®2
MYOCARDIAL PROTECTION SYSTEM





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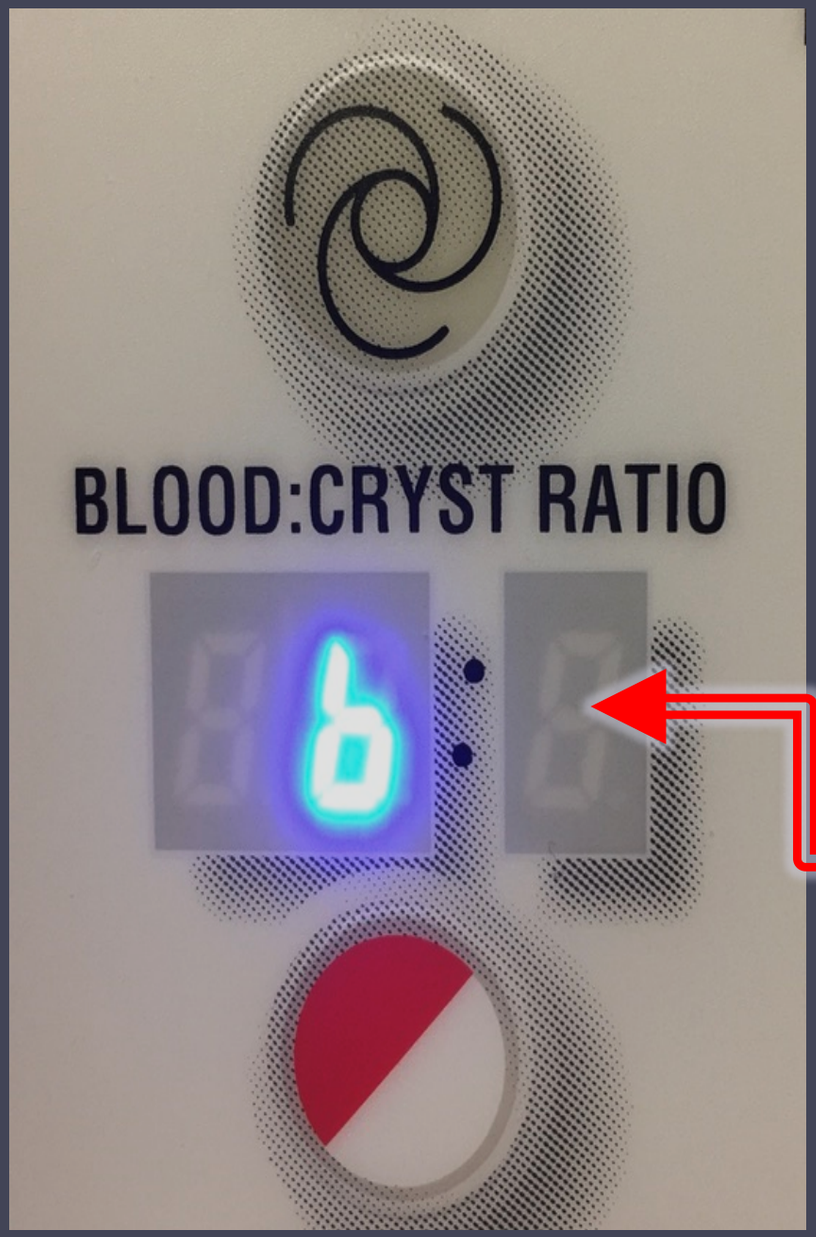
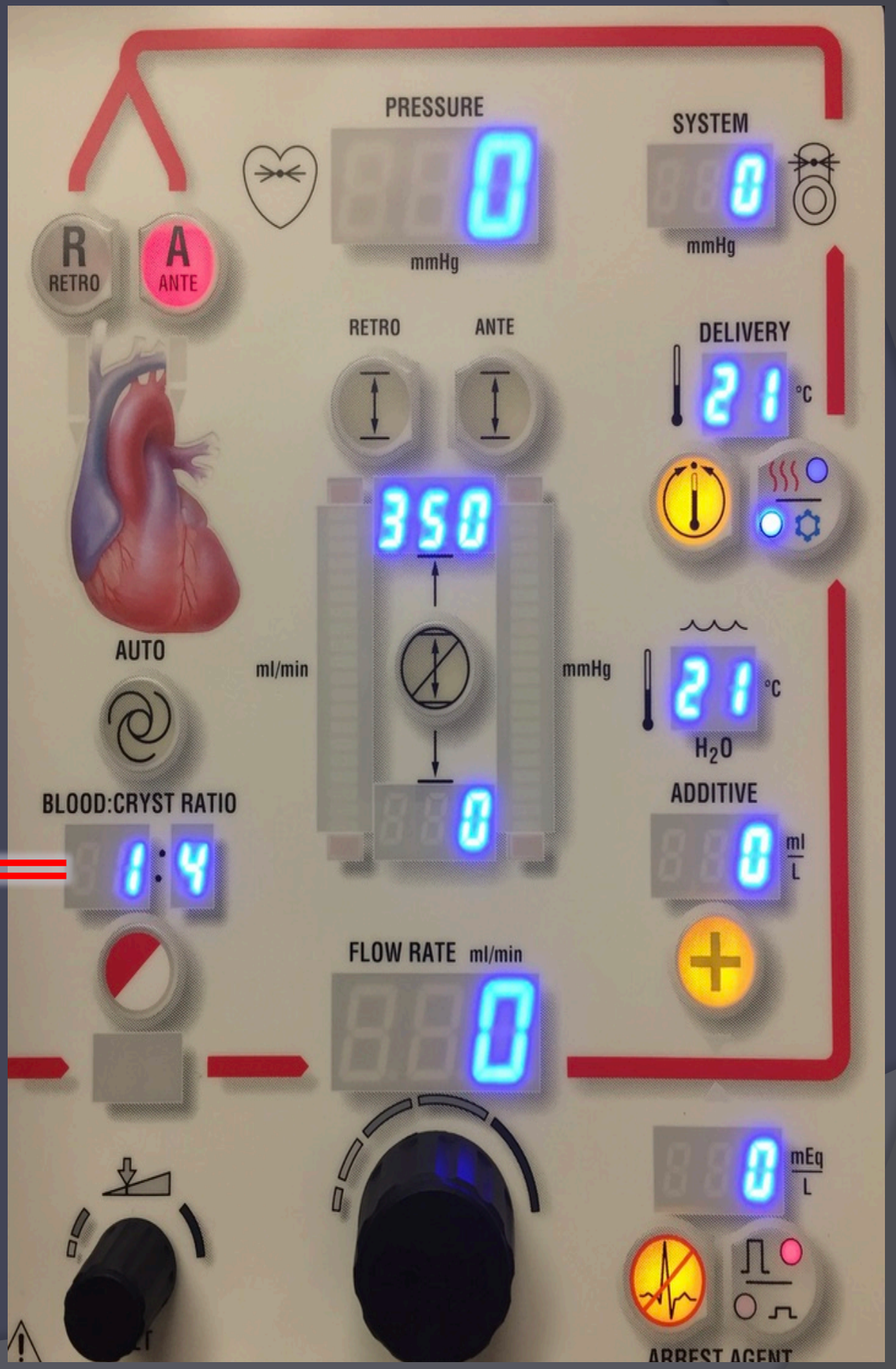
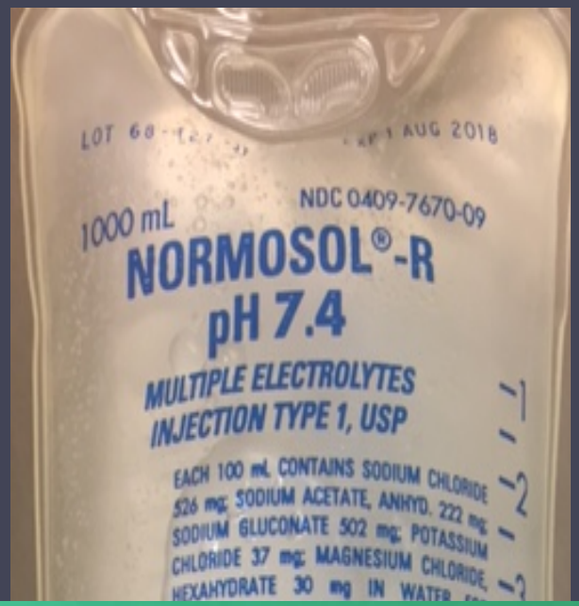

BLOOD:CRYST RATIO
6
:

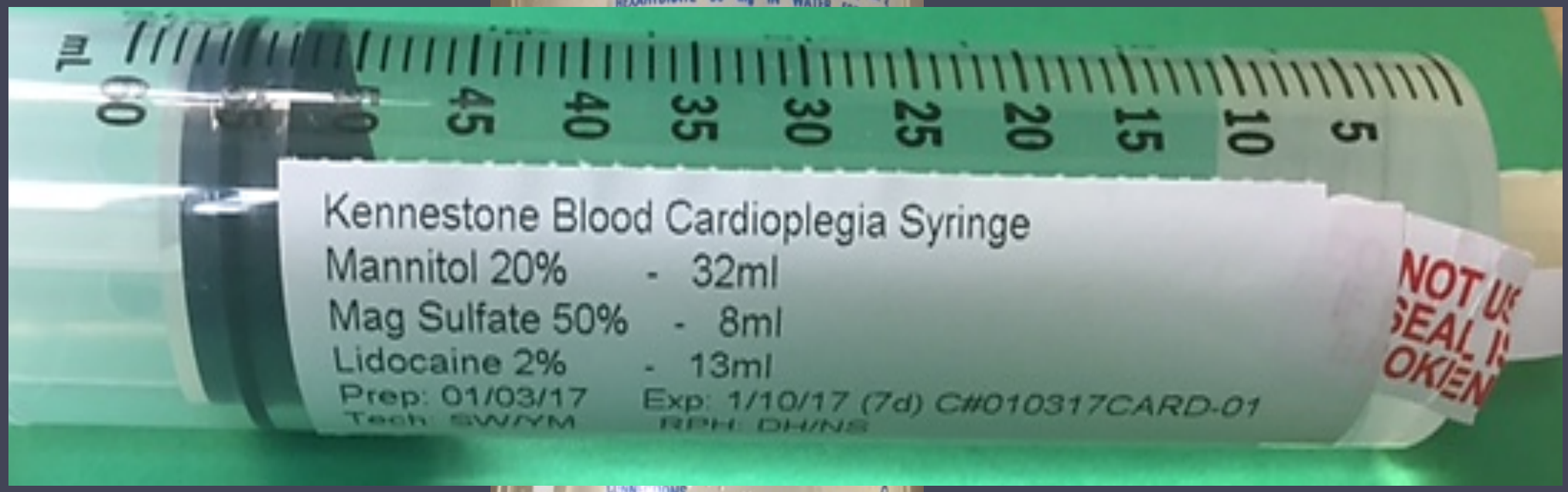

PRESSURE
0
mmHg
SYSTEM
0
mmHg
R
RETRO
A
ANTE
RETRO
ANTE
DELIVERY
21
°C
350
AUTO
ml/min
mmHg
21
°C
H2O
BLOOD:CRYST RATIO
1:4
0
ADDITIVE
0
ml/L
FLOW RATE ml/min
0
0
mEq/L
ARREST AGENT

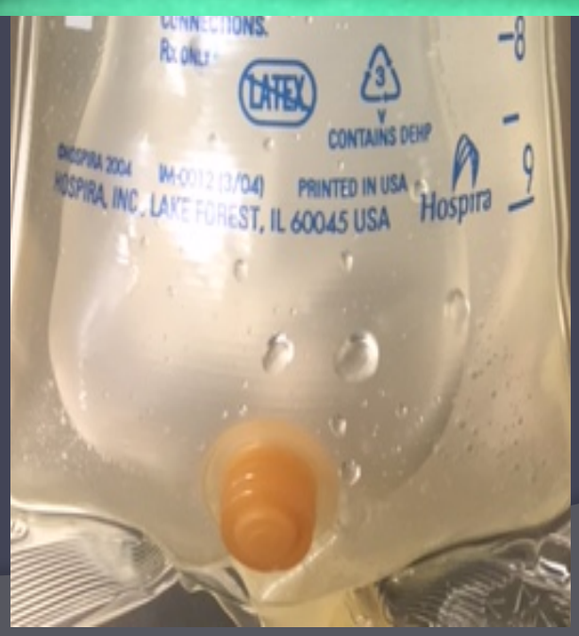
Benefits of Blood Cardioplegia

- Decreased systemic hemodilution
- Improved glucose management
- Maximized oxygen carrying capacity
- Reduced myocardial edema
- Physiologically buffered

Why revert back to crystalloid if you don’t have to?


1000 mL
NDC 0409-7670-09
NORMOSOL®-R
pH 7.4
MULTIPLE ELECTROLYTES
INJECTION TYPE 1, USP


Kennestone Blood Cardioplegia Syringe
Mannitol 20% - 32ml
Mag Sulfate 50% - 8ml
Lidocaine 2% - 13ml
Prep: 01/03/17 Exp: 1/10/17 (7d) C#010317CARD-01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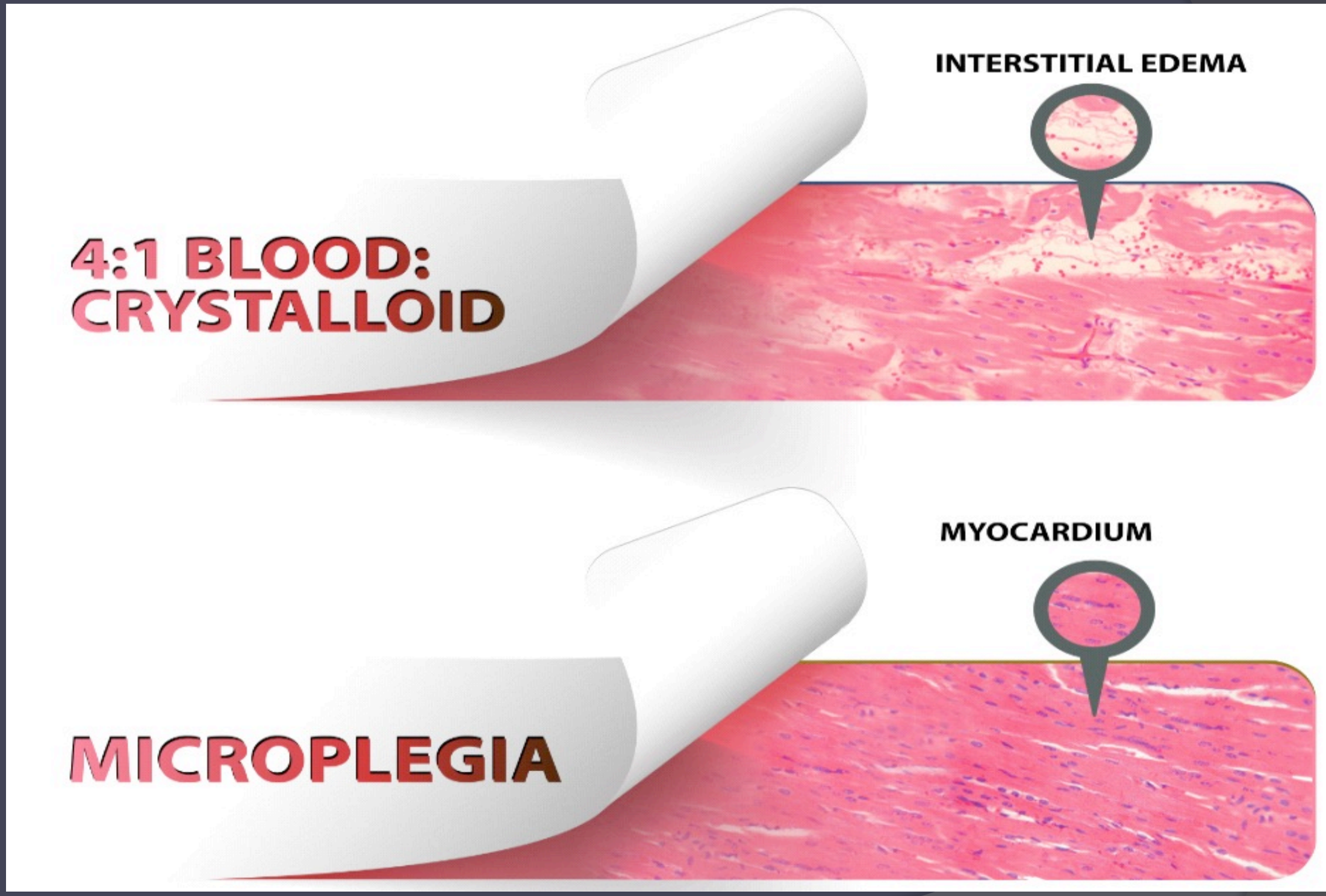


Slide credit: Quest Medical

1. Spotnitz HM, Effects of edema in systolic and diastolic function in vivo. J Card Surg 1995(suppl 4):454-9.

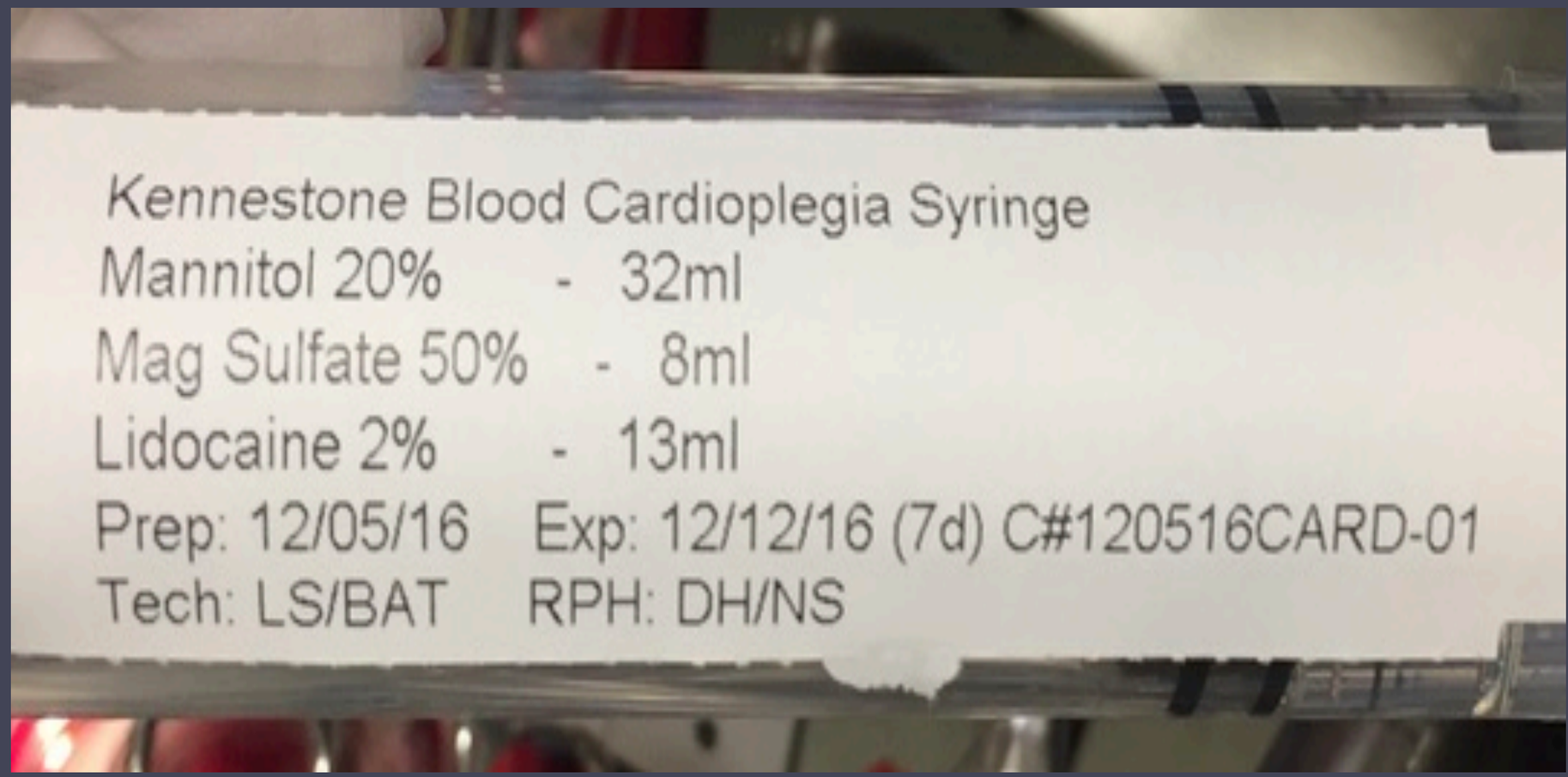
Give the patient

their **own** blood.

THE KBC METHOD

KBC Composition

- Blood as the buffer
- Potassium
- Lidocaine
- Magnesium Sulfate
- Mannitol



- Prepared by in house pharmacy
- 7 day expiration refrigerated

Change the way we think about cardioplegia.

KBC Method

- Induction Dose
- Dosing Assessment
- Reanimation Dose

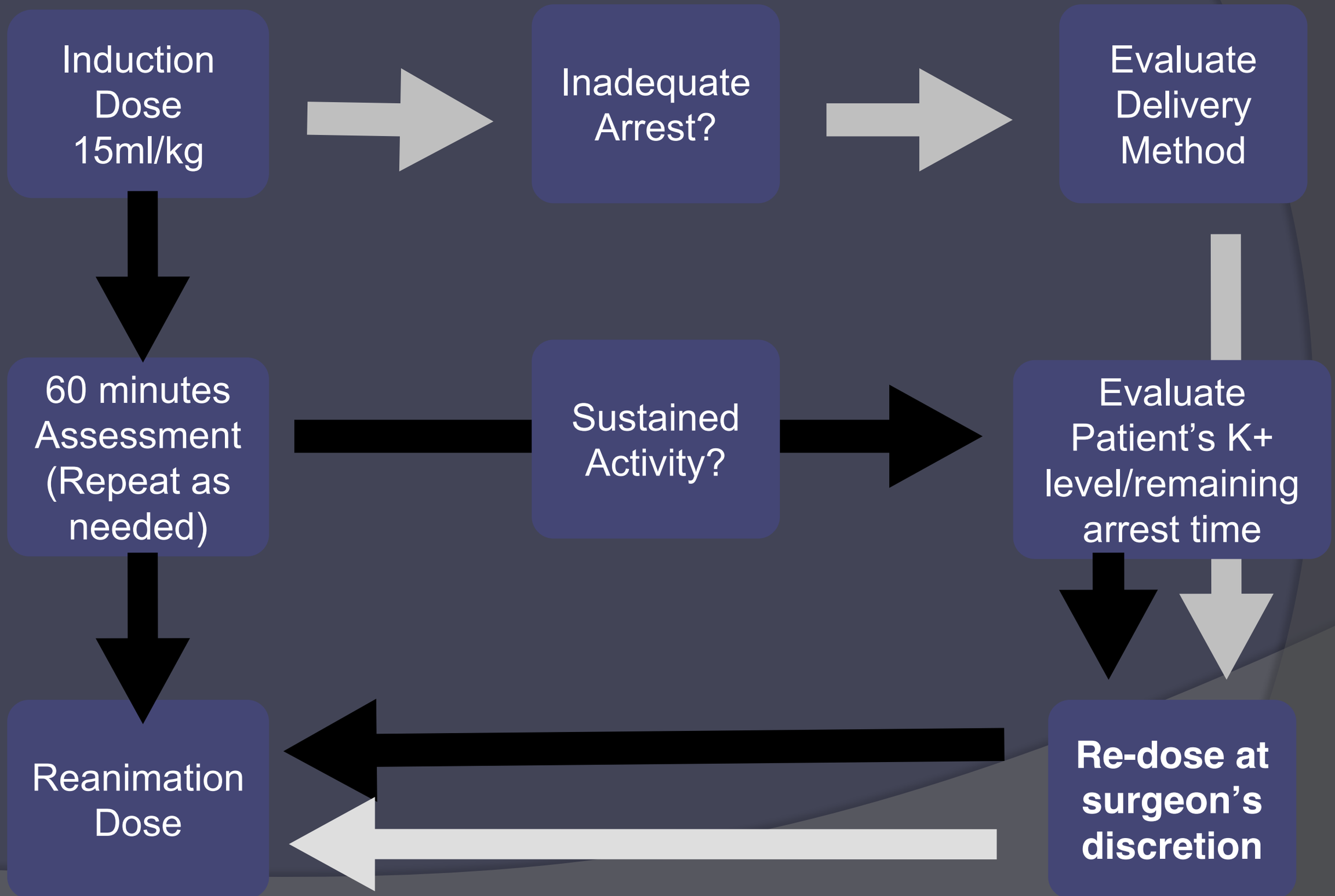
Induction Dose

- Weight Based-15ml/kg
- Minimum of 1000ml, Maximum of 1500ml
- Cold
- Arrest and Additive Setting of 21

Drug Delivered in 1L

- 2.5g Mannitol
- 1.6 g Mag Sulfate
- 100mg Lidocaine
- 21 mEq KCL

Dosing Assessment



Previous Warm Dose

Bolused prior to cross-clamp removal:

- 200mg Lidocaine
- 2.5g Magnesium Sulfate
- 100mg Esmolol

Reanimation Dose

- 400ml Warm, No Potassium
- Variable Additive Setting:

Time since last dose	Additive Setting
> 60 minutes	21
31-59 minutes	10
<30 minutes	0

Procedure Specific Adaptation

- X-clamped CABG:
  - Usual induction dose
  - Cold blood down the veins
    - **Beyond 200ml, Additive/Arrest setting to 10**
- Reanimation dose

Key Points

- Importance of a good initial arrest.
- Minimize doses given within an hour of x-clamp removal.
- Dosing Assessment is key!

COMMUNICATION


...AND THAT IS WHY WE LIFT ON THREE...
COMMUNICATION
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dolighan.com

The Role of the Perfusionist:

- Provide Information:
  - Any noted EKG Activity
  - K^+ level
  - Arrest time
  - Help guide additive and arrest settings
- Ask the right questions:
  - Estimated remaining arrest time?
  - Delivery route?
  - Adequate distribution?

The Role of the Surgeon:

- Note visible activity
- Evaluate distribution and delivery method
- Communicate:
  - Change in procedure altering x-clamp time
  - Excessive collateral flow or reason for washout
  - Heart not empty
  - Compliment the perfusionist!

A SURGEON'S PERSPECTIVE

William A. Cooper, MD, MBA
Medical Director, Cardiovascular Surgery
WellStar Health System

Cardioplegia is one of the most important things we do!

Milestones and Mirrors Protecting the heart? A Historical Look Back

Milestones and Mirrors: Protecting the heart? A Historical Look Back

- Hypothermia, systemic and/or supplied by topical cooling (Bigelow et al. 1950; Shumway et al. 1959; Swan 1973)
- Global ischemia with continuous or intermittent aortic occlusion (Cooley et al. 1962) and
- Aortic root or intracoronary perfusion with blood (Kay et al. 1958) and, when needed, electively induced ventricular fibrillation (Senning 1952).

Milestones and Mirrors: Protecting the heart? A Historical Look Back

- ***Chemical arrest*** or the sparing of cell energy through rapid induction of arrest in diastole.
- ***Hypothermia*** or slowing the rate of cellular reactions thereby delaying energy decay and other deleterious processes during ischemia.
- ***Additional protection*** related to protective agents that prevent or reverse unfavourable ischemia-induced cellular changes

Milestones and Mirrors: Protecting the heart? A Historical Look Back

- 1960s
  - Bretschneider-hypothermia, K, Mg
  - Sondergaard-
- 1970s
  - Buckberg-K, blood
  - Bleese and Do¨ring-oxygenation
  - Braimbridge-St. Thomas
- 1980s/1990s
  - Temperature management-local, systemic
  - Distribution-antegrade, retrograde
  - Intermittent, continuous
  - Acid-Base
  - Pressure/Flow dynamics

Milestones and Mirrors: Protecting the heart? A Historical Look Back

- 2000s and beyond
  - Pre/Post-conditioning
  - Emergence of minimally invasive interventions
  - Blood management
  - Glucose management
  - Systemic and neurocognitive effects

Cardioplegia Goals

- Rapid induction, maintenance and easy reversal of cardiac arrest
- A relaxed heart to allow for mobilization and traction, a preferably
- A bloodless and unobscured operative field
- Sufficient time for adequate correction of cardiac or coronary defects

Beyond the CVOR:
The Influence of Value-Based Care

- The Value Matrix
  - Quality
  - Cost
  - Access
- Reduce Variability--STANDARDIZE
- Patient Experience-QUALITY
- Resource Utilization-COST

The Importance of Standardization

Blood Cardioplegia Formulas

Product Code	Product Description
66647-0110-06	Induction 4:1 High K (30 mEq) 415 mL, Bag
66647-0110-00	Induction 4:1 High K (60 mEq) 830 mL, Bag
66647-0110-01	Induction 4:1 High K (36 mEq) *Low Tromethamine* 500 mL, Bag
66647-0110-02	Induction 8:1 High K (108 mEq) 500 mL, Bag
66647-0110-07	Induction 8:1 High K (100 mEq) *LOW DEXTROSE* 500 mL, Bag
66647-0100-02	Warm Induction 4:1 High K (40 r
66647-0100-03	Warm Induction 4:1 High K (80 r
66647-0100-11	Warm Induction 4:1 High K (40 r
66647-0100-04	Warm Induction 8:1 High K (66 r
66647-0110-03	Maintenance 4:1 Low K (20 mEq
66647-0110-04	Maintenance 4:1 Low K (36 mEq
66647-0110-05	Maintenance 8:1 Low K (24 mEq
66647-0110-08	Maintenance 8:1 Low K (36 mEq
66647-0100-05	Reperfusate NO K 238.75 mL, B
66647-0100-06	Reperfusate NO K 477.5 mL, Ba
66647-0100-07	Reperfusate 4:1 Low K (7.5 mEq
66647-0100-08	Reperfusate 4:1 Low K (15 mEq)
66647-0100-09	Reperfusate 4:1 Low K (15 mEq)
66647-0100-10	Reperfusate 8:1 Low K (32 mEq)

Additional Blood Cardioplegia Formulas

Product Code	
66647-0120-08	Induction 4:1 High K (30 mEq) in
66647-0120-07	Maintenance 4:1 Low K (30 mEq
66647-0120-06	Induction 4:1 High K (48 mEq) in
66647-0120-05	Maintenance 4:1 Low K (12 mE

CAPS®
Central Admixture Pharmacy Services, Inc.

Crystalloid Cardioplegia Formulas

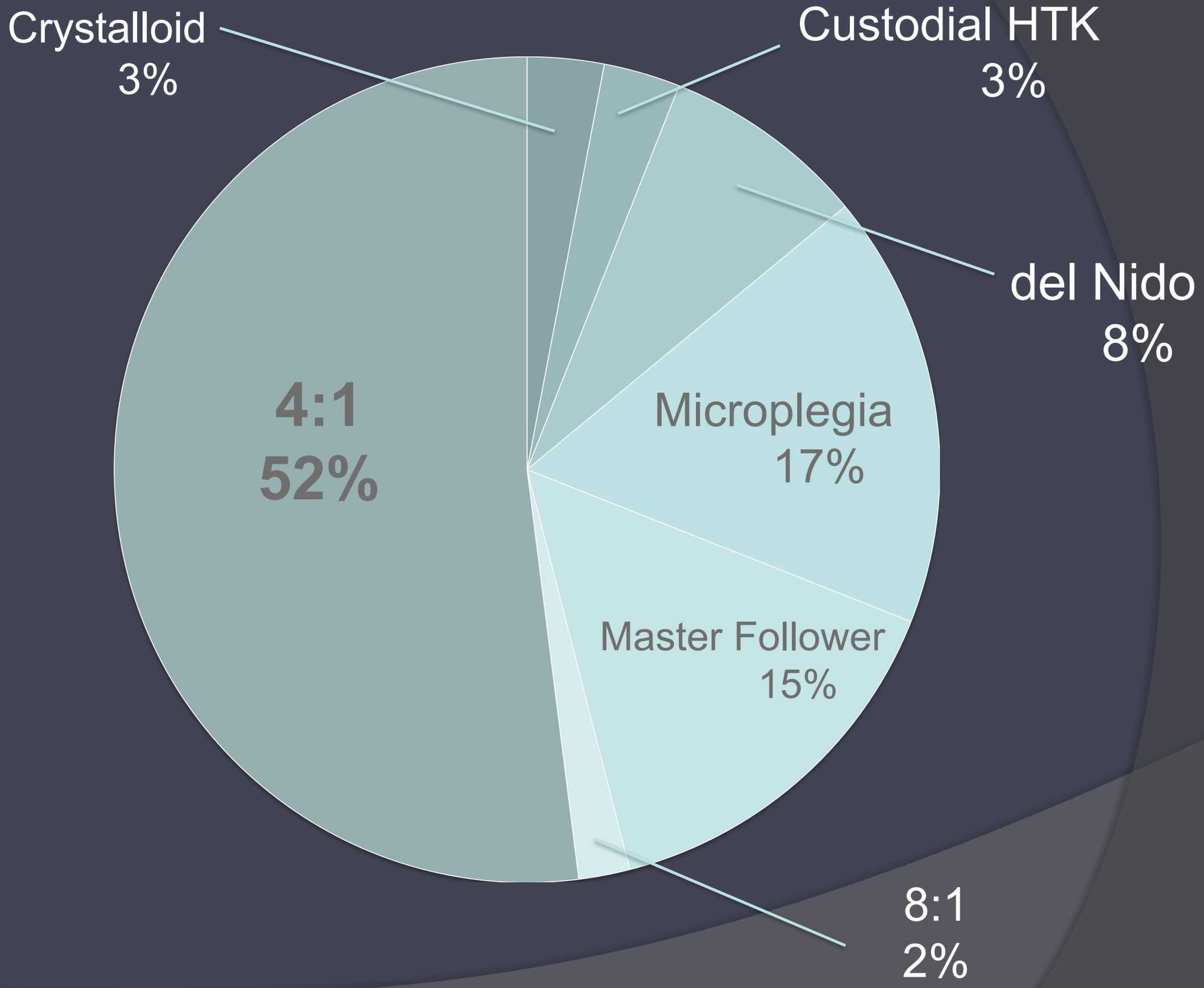
Product Code	Product Description
66647-0120-09	Modified St. Thomas Formula High K (136 mEq) 1116 mL, Bag
66647-0120-10	Modified St. Thomas Formula Low K (76 mEq) 1086 mL, Bag

Other Cardioplegia Formulas

Product Code	Product Description
66647-0120-01	del Nido Formula 1052.8 mL, Bag

Product Code	Product Description
66647-0020-00	Adenosine Lidocaine Magnesium Sulfate 40 mL, Syringe

Product Code	Product Description
66647-0100-01	Microplegia (MSA/MSG 0.92 Molar) 125 mL, Bag
66647-0000-00	Microplegia (MSA/MSG 0.92 Molar) 50 mL, Syringe



Slide by: Kyra Grathwohl

KBC

THE STANDARD FOR ALL BLOOD MICROPLEGIA

Desired method for all cardiac patients.

CABG Patients

- On pump, warm beating
- Off pump
- Large CABG/Valve Population

What are the concerns?

- Temperature
- Distribution
- Longer x-clamp times
- Repeated dosing – “comfort” vs. need

Challenges

- Minimally invasive
- Ablation
- Lidocaine dosing
- Lidocaine allergies

Four Years …

over 1500 cardiac patients.

What’s next?

For more information related to the KBC Protocol, please contact us:

Candice.Kalin@wellstar.org

Catherine.Lunsford@wellstar.org

References

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