

# LACTATED RINGER & RAPID INFUSION



CLINICAL BEST PRACTICES – JULY 2020

Internal Use Only



# OBJECTIVES

- Provide a recommended response when a customer asks if they can use lactated ringers with the Belmont® Rapid Infuser RI-2
- Provide background explaining the 'why' behind our response



# WHAT IS LACTATED RINGER?

Ringer's lactate solution (RL), also known as **sodium lactate solution** and **Hartmann's solution**, is a mixture of sodium chloride, sodium lactate, potassium chloride, and calcium chloride in water.

RL is used for replacing fluids and electrolytes in patients who have low blood volume or low blood pressure.



# WHAT IS SODIUM CITRATE?

Sodium citrate is...

- The trisodium salt of citric acid and is used to prevent donated blood from clotting in storage.
- A component of the AS-3 additive solution which is commonly used in the USA for blood storage.

## How Does Sodium Citrate Prevent Clotting In Blood?

The citrate ion chelates calcium ions in the blood by forming calcium citrate complexes, disrupting the blood clotting mechanism.

# COMBINING LR AND CITRATED BLOOD

1. When infusing Ringer's lactate solution (LR) with the blood, the calcium in LR will exceed the chelating capabilities of the citrate in the stored blood, resulting in clot formation.
2. These clots could then enter the circulation and compromise the microcirculation, particularly the pulmonary capillaries and small vessels.



# NOT ALL RED BLOOD CELL (RBC) ADDITIVE SOLUTIONS USED AROUND THE GLOBE CONTAIN NA-CITRATE<sup>1</sup>

Constituents (mM)	Licensed RBC additive solutions					MAP	PAGGSM MacoPharma
	SAG-M	AS-1 Adsol Baxter	AS-3 Nutricel Pall Medical	AS-5 Optisol Terumo			
NaCl	150	154	70	150			
NaHCO <sub>3</sub>	-	-	-	-			
Na <sub>2</sub> HPO <sub>4</sub>	-	-	-	-			
NaH <sub>2</sub> PO <sub>4</sub>	-	-	23	-			
Citric acid	-	-	2	-			
Na-citrate	-	-	23	-			
Adenine	1.25	2	2	2.2			
Guanosine	-	-	-	-			
Dextrose (glucose)	45	111	55	45			
Mannitol	30	41	-	45.5			
pH	5.7	5.5	5.8	5.5			
Anti-coagulant	CPD	CPD	CP2D	CPD			
FDA Licensed	No	Yes	Yes	Yes			
Countries used	Europe UK Australia Canada New Zealand	USA	USA Canada	USA	Japan	Germany	

Customers might refer to the use of LR's in other countries. The difference is that those countries might not use the AS-3 Sodium Citrate additive.

1. Sparrow RL. Time to revisit red blood cell additive solutions and storage conditions: a role for "omics" analyses. Blood Transfus. 2012;10 Suppl 2



# AABB - AMERICAN ASSOCIATION OF BLOOD BANKS

- Sets standards and delivers accreditation and educational programs that focus on optimizing patient and donor care and safety including guidelines on blood donation, storage and transfusion procedures
- AABB guidelines for transfusing medications or solutions with blood products:
  - “No medications or solutions may be added to or infused through the same tubing simultaneously with blood components, with the exception of 0.9% Sodium Chloride, Injection (USP) unless: 1) they have been approved for this use by the FDA, or 2) there is documentation available to show that the addition is safe and does not adversely affect the blood or blood component”<sup>2</sup>
  - “Lactated Ringer's Injection (USP) or other solutions containing calcium should never be added to or infused through the same tubing with blood or blood components containing citrate”<sup>2</sup>

2. Circular of Information for the use of human blood and blood components from the AABB, American Red Cross, America's Blood Centers and ASBP, 2017- Pg. 4



# OTHER POTENTIAL PUSHBACKS

- "I've read articles about the successful use of LR with RBC's... why can't I use it with the Belmont?"
  - "Ringer's lactate is compatible with the rapid infusion of AS-3 preserved packed red blood cells."<sup>3</sup>
  - "A comparison of LR and NS with rapid infusion rates of blood showed no significant difference between infusion time, filter weight and clot formation. Blood bank guidelines should be revised to allow the use of LR in the rapid transfusion of PRBC."<sup>4</sup>
  - **Our Response:**
    - "Yes, I've seen those articles, but Belmont will continue to follow the current AABB Guidelines."
- "I've read that if you give LR and blood quickly, they won't clot..."
  - **Our Responses:**
    - "Yes, I've seen those articles, but Belmont will continue to follow the current AABB Guidelines."

3. Albert, K., van Vlymen, J., James, P. et al. Ringer's lactate is compatible with the rapid infusion of AS-3 preserved packed red blood cells. *Can J Anesth/J Can Anesth* **56**, 352 (2009). <https://link.springer.com/article/10.1007/s12630-009-9070-5>
4. Lorenzo M, Davis JW, Negin S, et al. Can Ringer's lactate be used safely with blood transfusions?. *Am J Surg.* 1998;175(4):308-310. doi:10.1016/s0002-9610(98)00011-7 [https://www.americanjournalofsurgery.com/article/S0002-9610\(98\)00011-7/fulltext](https://www.americanjournalofsurgery.com/article/S0002-9610(98)00011-7/fulltext)





# KEY TAKE AWAYS

We follow the AABB Guidelines!

Solutions not to be administered with blood components include:

- Solutions containing dextrose<sup>2</sup>
- Lactated Ringer's solution or other solutions containing high levels of calcium <sup>2</sup>





## Bibliography

1. Sparrow RL. Time to revisit red blood cell additive solutions and storage conditions: a role for "omics" analyses. *Blood Transfus.* 2012;10 Suppl 2
2. Circular of Information for the use of human blood and blood components from the AABB, American Red Cross, America's Blood Centers and ASBP, 2017– Pg. 4
3. Albert, K., van Vlymen, J., James, P. et al. Ringer's lactate is compatible with the rapid infusion of AS-3 preserved packed red blood cells. *Can J Anesth/J Can Anesth* 56, 352 (2009).  
<https://link.springer.com/article/10.1007/s12630-009-9070-5>
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