

Guidelines for Use of Citrate Dialysate (Citrasate®)

Purpose:

Citrasate® contains a small amount of anticoagulant (citric acid) and thereby can provide some anticoagulation benefit for the extracorporeal hemodialysis circuit in cases where heparin is contraindicated or is ineffective. Such cases include but not limited to:

- Heparin Induced Thrombocytopenia (HIT)
- Heparin allergies
- Risk of bleeding (trauma, surgery, GI bleed, or where heparin has proven ineffective in preventing clotting of the extracorporeal circuit).
- Low platelet count

I. Policy/Procedure:

- A. Citrate dialysate will be ordered by the physician by trained dialysis staff (doctor, nurse or technician) under the following conditions:
 - For patients with Heparin-induced Thrombocytopenia (HIT).
 - For patients with diagnosed or suspected allergy to heparin.
 - When heparin is either contraindicated or is prescribed in a low dose, due to some risk of bleeding.
 - When heparin is ineffective in preventing clotting of the extracorporeal dialysis circuit to the point where the patient's treatment is adversely affected.
 - To increase dialyzed reuse, especially for poor reuse patients.
- B. Verify physician order, and assure that the correct dialysate, both the concentration - proportioning ratio and formulation, is obtained.
- C. Attach the citrate dialysate jug to dialysis machine using the acid port
- D. Run treatment per physician's prescribed time.
- E. After treatment is completed, label remaining acid concentrate with time and date or discard remaining acid concentrate. Never use acid or bicarbonate concentrate that has been opened or prepared for >24 hours.

II. Cautions:

Although very rarely occurring, be aware of symptoms of a patient reaction to citrate: During treatment assess the patient for signs of hypocalcemia; numbness/tingling around the mouth, unusual muscle cramps (in length or severity). If symptoms occur, place machine in bypass and notify the doctor. Symptoms should resolve within minutes because any excess citrate is quickly metabolized.

Documentation:

Chart dialysate type and otherwise normally document treatment in the patient's medical record.

Rationale/Background:

- Citrate dialysate contains citric acid - a physiological acid that the body can quickly metabolize and which also has anticoagulation properties. The anticoagulation mechanism of citrate dialysate occurs because citrate binds to calcium (ionized or “free” calcium), thus removing calcium from the blood clotting cascade. Citrate dialysate provides no measurable systemic anticoagulation, however its introduction at the dialyzer provides some local anticoagulation benefit in the dialyzer and the venous portion of the extracorporeal circuit. Upon reentering the systemic circulation blood calcium levels rapidly return to normal.
- Citrasate[®] is packaged in ready-to-use 1-gallon jugs. Citrate Dialysate (Citrasate[®]) contains 2.4 mEq/L of citrate and 0.3 mEq/L of acetate. Other chemicals are similar to regular dialysate.
- In many thousands of **acute** HD treatments done at the University of Washington Medical Center over the past 4 years no arrhythmias, clinically significant changes in serum values, or any other adverse affects have been reported.
- Citrasate[®] has also been used for long-term treatment (up to three years) of **chronic** hemodialysis patients without any adverse changes in blood chemistries or other affects.
- It has been reported (Ahmad et al) that the use of citrate dialysate may temporarily (during dialysis) decrease ionized calcium levels by approximately 10% and may, particularly with repeated long-term treatment, increase bicarbonate levels. Citrate is also known to bind with magnesium. Therefore, particularly in the inpatient setting, you may want to monitor these factors, but this is not routinely necessary.

Additives

You can use additives with Citrasate just like you use them for your regular acid concentrate.

First, you must determine:

- Who is allowed to perform the additive mixing (clinical or technical staff or both).
- The dialysis machine proportioning ratio (35X, 36.83X or 45X)
- The acid container volume (Citrasate gallon jug is 3.785 liters).
- The chemical composition of your acid concentrate
- The type of electrolyte additive required, for example (KCl, CaCl₂, etc.)

Calculate (per additive manufacturer's instructions*) the amount of additive needed to raise the desired electrolyte to the level required.

Add the additive to the acid container and mix thoroughly. Be sure to label the container with the new electrolyte level. Your spiked Citrasate is ready to use. If required, have clinical staff perform appropriate sign off, showing correct additive was used.

* If you need additives, please call RenalBuy at 877-569-2662 or Dial Medical at 800-346-2080

References:

1. Tu A, Ahmad S. Heparin-free hemodialysis with citrate-containing dialysate in intensive care patients. *Dialysis & Transplantation*, 29(10):620-624, 2000.
2. Ahmad S et al. Dialysate made from dry chemicals using citric acid increases dialysis dose. *Am J Kidney Dis*. 35(3):493-499, 2000.
3. O'Shea S, et al. Alternative Methods of Anticoagulation for Dialysis-dependent Patients with Heparin-induced Thrombocytopenia. *Seminars in Dialysis*, Vol. 16, No 1, 61-67, 2003.
4. Mureebe L, et al. Heparin-associated antiplatelet antibodies increase morbidity and mortality in hemodialysis patients. *Surgery*, Vol. 136, No. 4:848-853, 2004.
5. Ahmad S, et al. Increased Dialyzer Reuse with Citrate Dialysate. *Hemodialysis International*, in press.

Citrasate[®] and Calcium

Citrasate, a new acid concentrate for bicarbonate dialysis, is unique because it uses citric acid rather than acetic acid for acidification. Citrate is a well known anticoagulant that functions by binding serum calcium thereby reducing the calcium available to participate in the blood's clotting cascade. This characteristic of Citrasate, its ability to reduce clotting, makes it very useful for treating patients that either can't use Heparin or for those for whom Heparin is ineffective.

A frequent question that normally follows the understanding that Citrasate contains citric acid is: **Do we need to be concerned with hypocalcemia? The answer is no.** The concentration of citrate in Citrasate is only 2.4 mEq/L; only about one-fifth of the concentration used to achieve anticoagulation via traditional regional citrate infusions. The use of Citrasate does not produce measurable systemic anticoagulation, the anticoagulant effect is confined to the dialyzer and the venous side of the dialysis set up. Citrasate generally produces a clinically acceptable transitory reduction (about 10%) in ionized calcium¹. Ionized calcium begins to normalize to the pre-dialysis level as soon as the Citrasate dialysis session stops¹. The consistent treatment of chronic dialysis patients with Citrasate has demonstrated no change over extended time periods in either total or ionized serum calcium levels¹.

(1) Ahmad S, Callan R, Cole JJ, Blagg CR. Dialysate made from Dry Chemicals using Citric Acid Increases Dialysis Dose. *American Journal of Kidney Diseases* 2000; 35: 493-499.