CITRATE-BASED DIALYSATE AND MUSCLE CRAMPS: A SIGNIFICANT PROPORTION OF DIALYSIS PATIENTS COULD HAVE A REDUCED CITRATE METABOLIZING CAPACITY

Category: Dialysis, Extracorporeal dialysis: techniques and adequacy

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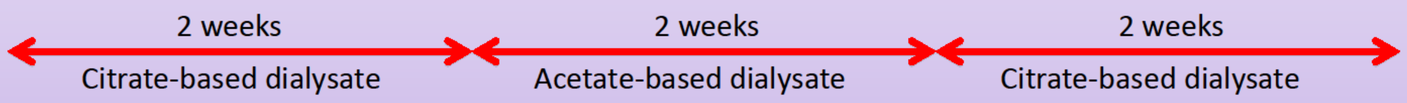
Background : Patients on chronic hemodialysis (HD) have complained of severe muscle cramps after switching from Hydrochloric to Citric acid-based dialysate. Our study aimed to explore the possible link between muscle cramps and citrate-based dialysate.

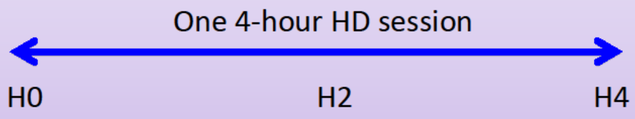
STUDY DESIGN: 2 steps

STEP 1: To bring out the relationship between muscle cramps and citrate-based dialyate: Prospective cross-over single blind study. Total study period: 6 weeks broken down into 3 consecutive 2-week phases. Phase 1 using citrate-based dialysate; Phase 2 using acetate-based dialysate; Phase 3 using citrate-based dialysate once again. Except for the acid buffer, dialysate formulation was identical in the 3 phases. The primary criteria was the occurrence of significant muscle cramps.



N = 14 patients (all patients from 1 dialysis unit)

STEP 2: To study the physiopathology of muscle cramps, blood kinetic analysis for citric acid, ionized Ca, Mg and iPTH during one HD session in 3 patients with severe muscle cramps. Assays were analyzed at session start (H0), mid-session (H2) and session end (H4).

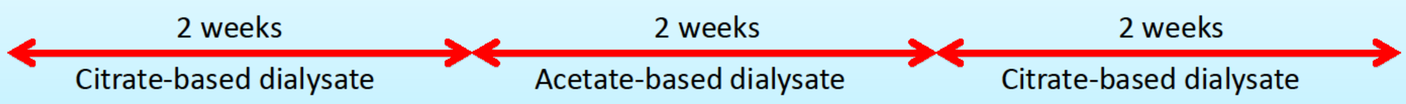


N = 3 patients with severe muscle cramps

RESULTS

STEP 1:

Compared to acetate-based dialysate, citrate-based dialysate was linked to severe muscle cramps:
33 episodes in 84 HD sessions versus 3 episodes in 42 HD sessions (95%CI [1.6;29.4]; p=0.003).



17 episodes of severe muscle cramps in 5 patients

3 episodes of severe muscle cramps In 3 patients

16 episodes of severe muscle cramps in 5 patients

STEP 2:

Patients suffering from muscle cramps significantly increased citrate blood levels during HD sessions, 3-fold up the normal value (p=0.0006). Patients suffering from muscle cramps had high basal (H0) citrate blood levels, i.e. they could not correctly metabolize citrate during and between the HD sessions.

CITRATE-based dialysate	H0 Start-session	H2 Mid-session	H4 End-session	
Ionized Ca (mg/dL) Normal values: 4.0-5.5	4.5	4.1	4.2	Normal range. No significant change.
Mg sérique (mg/dL) Normal values: 1.6-2.4	1.9	1.8	1.7	Normal range. No significant change.
Blood citrate level (mg/dL) Normal values: 1.5-2.5	**3.7**	**7.8**	**7.9**	**High values. Significant increase**.
iPTH (pg/mL) Normal values: 15-65	225	193	181	Normal range. No significant change.

CONCLUSION

This study highlights the relationship between muscle cramps and citrate-based dialysate for a significant proportion of HD patients. For these patients, normal range in ionized Ca and Mg blood levels and the absence of significant change during HD session, suggests that cramps are not due, in our study, to the chelation of Ca and/or Mg by citrate. Patients suffering from muscle cramps had high basal (H0) citrate blood levels, i.e. they could not correctly metabolize citrate during and between the HD sessions. The reduced citrate metabolizing capacity could be related to a lack of a purine nucleotide cycle step in the muscle mitochondria cells, resulting in oxidation disorders in the Krebs cycle. A study is conducted to confirm this hypothesis.

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