Calcium Mass Balances in On-line Hemodiafiltration (HDF) Using Citrate-containing Acetate-free and Regular Dialysis Concentrates

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INTRODUCTION / AIM

Citrate-containing acetate-free haemodialysis concentrate may potentially improve removal efficiency and reduce the inflammatory impact of dialysis, but the propensity of citrate to form complexes with calcium (Ca) is likely to affect the Ca transport.

Recently evaluation on PTH level during citrate dialysis reported an increase of pre-dialytic level in 6 weeks [1].

The use of citrate dialysis fluid in high-volume online HDF could increase this phenomenon.

The **Aim** of this study was to evaluate the mass balance of Ca (CaMB) and Citrate (CitMB) during HDF with a new citrate containing acetate-free dialysis fluid versus a regular dialysis fluid.

METHODS

This randomized cross-over study enrolled 18 stable ESRD pts (71±11 yrs) regularly on 4.5 hours on-line postdilution HDF treatments. Dialysis fluid prepared from SelectBag® Citrate concentrate (Cit-, Gambro) was compared to regular dialysis fluid (Ac-, Softpac G, Gambro; see table 1). Each patient was treated for one week with Ac-HDF and then switched to Cit-HDF for another week, or viceversa. All patients were treated with 2.1 m2 Polyflux H dialyzers (Gambro). In the mid-week session of each period Ca (total and ionized) and citrate levels were measured in plasma and dialysis fluid at start, at 60 and 120 minutes, after start, and at end of treatment. CaMB and CitMB were calculated from total Ca and citrate levels in dialysis fluid. Citrate in plasma and dialysis fluid was analysed by suppressed-conductivity anion-chromatography. Anion-separator: 0.3x25 cm IonPac Fast Anion IIIA (Dionex Corp., U.S.A.); mobile phase: 20 mmol/L NaOH aqueous solution; flow-rate: 1.0 mL/min.

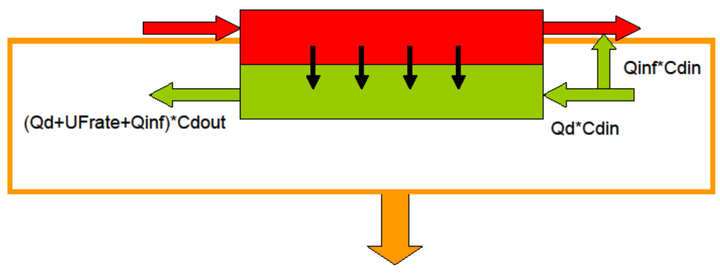

Figure 1: *Calculation of Mass Balance on hydraulic side used for Calcium and Citrate*

Dialysis Fluid (mM)	Softpac G	Selectbag Citrate
Na	140	140
K	3	3
Ca	1.50	1.50
Mg	0.5	0.5
Acetate	3	0
Citrate	0	1
Chloride	110.0	110.0
Glucosium (g/L)	1	1
Bicarbonate	34	34

Table 1: *Characteristics of Dialysis fluids used in the study*

RESULTS

The convective volume, set automatically by TMP biofeedback (UltraControl, Gambro), was 26.3±3.3 in Ac-HDF and. 26.0±3.9 l/session in Cit-HDF (p=0.73).

Calcium

Using 1.5 mM Ca in dialysis fluid, the plasma total Ca level was stable during Cit-HDF treatments (from 2.37±0.14 to 2.42±0.11 mM, p=0.13), while it increased during Ac-HDF treatments (from 2.31±0.12 to 2.63±0.16 mM, p<0.0001, fig.2).
The plasma ionized Ca level decreased during Cit-HDF treatments (from 1.12±0.07 to 1.07±0.03 mM, p<0.001) whereas it increased in Ac-HDF (from 1.13±0.05 to 1.22±0.03 mM, p<0.0001). CaMB was different between the two periods (p<0.0001): removal of 274±260 mg Ca in Cit-HDF versus delivery of 125±174 mg Ca in Ac-HDF (see table 2).

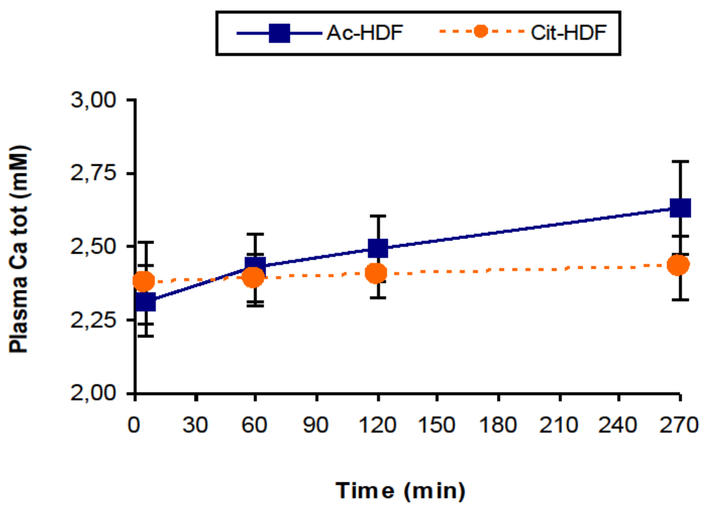

Figure 2: *Plasma total Calcium kinetic during online postdilution HDF with citrate (orange) or regular (blue) concentrate (p<0.01)*

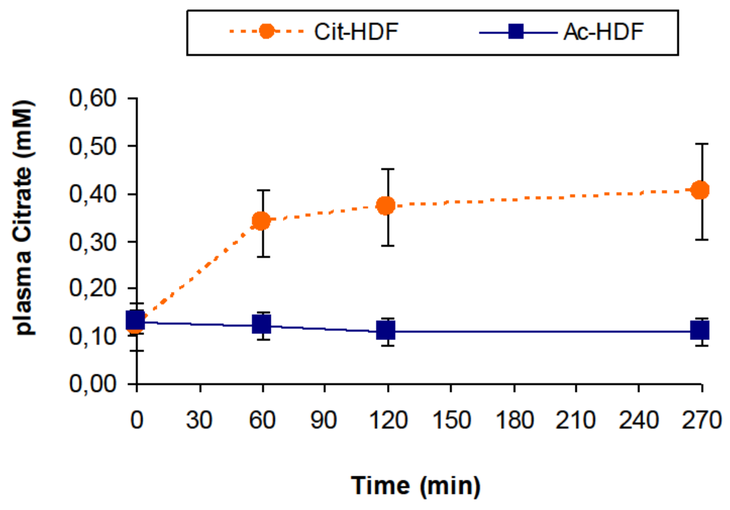

Figure 3: *Plasma Citrate kinetic during online postdilution HDF with citrate (orange) or regular (blue) concentrate (p<0.01)*

	Treatment time (min)			
CaMB (mg)	5	60	120	270
Ac-HDF	3±7	37±54	79±91	125±174
Cit-HDF	-7±8	-82±69	-167±123	-274±260

Table 2: *Total Calcium Mass Balance (CaMB), reported from patient point of view, during online postdilution HDF with citrate (Cit-HDF) or regular (Ac-HDF) concentrate*

	Treatment time (min)			
CitMB (g)	5	60	120	270
Ac-HDF	-0.02±0.01	-0.18±0.08	-0.37±0.16	-0,84±0.38
Cit-HDF	0.15±0.11	1.42±0.88	2.55±1.73	5,27±3.79

Table 3: *Citrate Mass Balance (CitMB), reported from patient point of view, during online postdilution HDF with citrate (Cit-HDF) or regular (Ac-HDF) concentrate*

CONCLUSIONS

With the same Ca concentration as in regular dialysis fluid the use of 1 mM citrate dialysis fluid in on-line postdilution HDF resulted in a different CaMB. Using a 1.5 mM Ca dialysis fluid, the intra-dialysis increase in total and ionized Ca levels seen with Ac-HDF was not seen with Cit-HDF. Our results suggest a need to re-evaluate the prescription of Ca in dialysis fluid when shifting to citrate-containing HD concentrates.

REFERENCES

1. Grundström G: Improved Acid-Base status by a novel safe Citrate containing Acetate-free Hemodialysis Fluid. Abstract accepted for ERA-EDTA Congress 2012

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