Baxter

Gambro

selectbag citrate

CITRATE DIALYSIS FLUID

Making possible personal.

A CITRATE CONTAINING DIALYSIS
FLUID FREE OF ACETATE

The Gambro **SelectBag Citrate** concentrate is a citrate-containing, acetate-free concentrate developed by Gambro for hemodialysis and hemodiafiltration treatments.

Citrate provides energy and buffering capacity to the patient. In addition, citrate is a well-known antioxidant and anticoagulant with potential benefits in dialysis to reduce inflammation, a risk factor for cardiovascular disease.[8]

It is a well-tolerated and biocompatible alternative to regular acetate-containing concentrates allowing for Individualized Quality-assured Dialysis (IQD).

PATIENT BENEFITS:

- Improved tolerance to treatment[1,2,3,4,5,6,7,8]
- Improved acid-base status[1,9]
- Less thrombogenic dialysis[1,10]

GAMBRO SELECTBAG CITRATE CONCENTRATE – A RANGE OF FEATURES AIMING TO IMPROVE PATIENT WELL-BEING

With the Gambro **BiCart Select Citrate** system it is easy to optimize dialysis fluid composition. The **SelectBag Citrate** concentrate provides an acetate-free dialysis fluid with all the beneficial properties of citrate.[1] Sodium and bicarbonate levels are accurately controlled to your settings, and the **SelectBag Citrate** concentrate allows you to easily vary calcium, potassium and glucose.

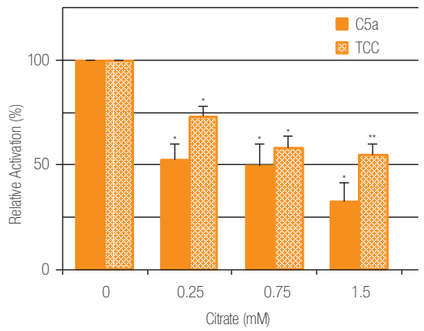
IMPROVED TOLERANCE TO TREATMENT

Citrate is an antioxidant and a natural source of cellular energy. *In vitro** data show that citrate, at levels similar to what is reached in plasma during citrate dialysis, protects against cellular injury, reduces inflammatory responses, and inhibits complement activation.[2,3] While acetate induces oxidative stress and pro-inflammatory responses in endothelial cells *in vitro*, citrate acts protectively.[4]

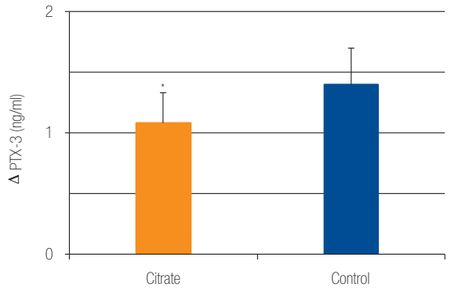
In a short term randomized controlled cross-over study, using the citrate containing dialysis fluid, citrate dialysis fluid reduced compared to control (acetate containing fluid), the intra-dialytic rise in pentraxin-3 (PTX-3), an inflammatory marker known to be induced by the hemodialysis treatment.[1,5]

No differences were detected regarding plasma levels or other markers of inflammation, including oxidative stress markers and AGEs.[1] A change to citrate dialysis fluid in stable hemodialysis patients has also been shown to lower IL-6 and CRP levels in plasma[6] and reduce post-dialysis malaise,[7] indicating an opportunity to improve patients' overall status.

Acetate-free dialysis fluid avoids the risk of intra-dialytic blood pressure drops induced by acetate.[7] *In vitro** data support the concept that impaired tolerance to fluid removal in the presence of acetate in dialysis fluid relates to increased nitric oxide production.[8]



Citrate inhibits in a dose dependent manner the generation of complement factors C5a and Terminal Complement Complex (TCC) in whole blood *in vitro*[6]. Data are shown as means ±SEM, * p<0.01, **p<0.001. Adapted from Huang[3].



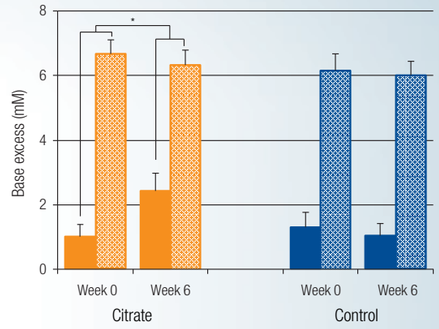
Reduced intra-dialytic increase in the inflammatory marker Pentraxin 3 (PTX-3) when using Gambro **SelectBag Citrate** dialysis fluid compared to control. Data are shown as means ±SEM, p=0.04. Adapted from Grundstrom.[1]

* Disclaimer: Preclinical results does not necessarily result in the same/identical clinical outcome.

IMPROVED ACID-BASE STATUS

Citrate is rapidly metabolized in the body into bicarbonate in a 1:3 molar ratio. Clinical data indicate that replacing acetate in dialysis fluid by citrate provides a more physiological correction of an acidotic state.[1,9]

In a short term randomized cross-over clinical study the citrate containing dialysis fluid concentrate, in comparison to a conventional concentrate, resulted in increased carbon dioxide pressure (pCO_2) and base excess levels pre dialysis – in both HD and HDF treatments – with a slight but significant increase in base excess also post-dialysis.[1] This suggests a clinically significant benefit of citrate containing dialysis fluid concentrate by decreasing the level of metabolic acidosis between dialysis sessions, potentially offering an opportunity to reduce the bicarbonate level in dialysis fluid during hemodialysis.



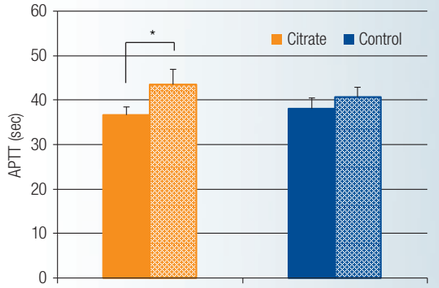
Increased pre-dialysis levels of base excess and reduced intra-dialytic change after six weeks using **SelectBag Citrate** dialysis fluid compared to control.[1] Solid bars represent pre-dialysis values and shadowed bars post-dialysis values. Data are shown as means ±SEM, p=0.03. Adapted from Grundstrom.[1] N=24

LESS THROMBOGENIC DIALYSIS

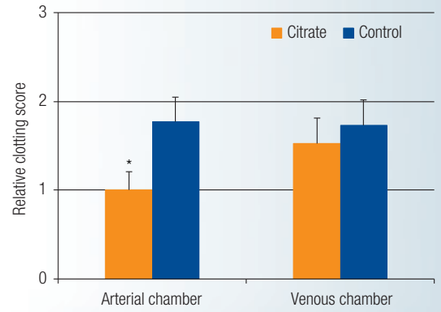
Citrate in plasma reduces the availability of free calcium ions and acts as anticoagulant in a concentration-dependent manner. Dialysis fluid prepared from citrate containing dialysis fluid concentrate does not eliminate the need for systemic anticoagulation. Yet, it may limit the thrombogenic potential of the extracorporeal circuit and allow for reduced heparin doses.[10]

In a short term randomized controlled cross-over clinical study using the citrate containing dialysis fluid concentrate, reduced thrombogenicity was indicated by a lower clotting score in the extracorporeal circuit.[1]

By reducing the risk of clotting in the extracorporeal circuit citrate dialysis fluid increases the possibility to deliver effective dialysis. Shifting to citrate dialysis fluid has been shown to increase ionic clearance[10] and delivered Kt/V.[11]



Increased Activated Partial Thromboplastin Time (APTT) post dialysis when using **SelectBag Citrate** dialysis fluid.[1] Solid bars represent pre-dialysis values and shadowed bars post-dialysis values. Data are shown as means ±SEM, p=0.003. Adapted from Grundstrom.[1] N=24

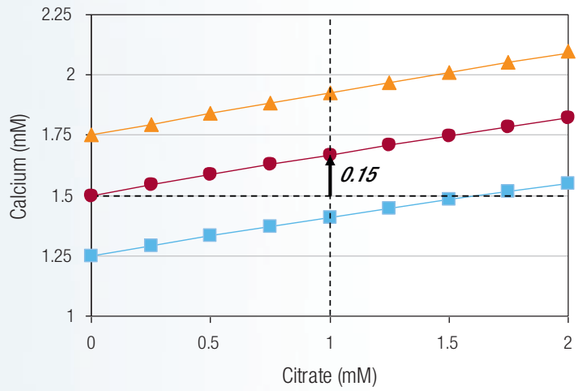


Less clotting in the arterial expansion chamber when using **SelectBag Citrate** dialysis fluid compared to control.[1] Clotting was judged on a scale from 0 (no clotting) to 4 (complete clotting). Data are shown as means ±SEM, p=0.03. Adapted from Grundstrom.[1] N=24

CALCIUM MASS BALANCE

Citrate in dialysis fluid decreases the concentration of free ionized calcium in plasma within the extracorporeal circuit and causes a change in total calcium mass transfer compared to dialysis fluids without citrate, if not compensated for by adjusting the calcium content of the dialysis fluid.

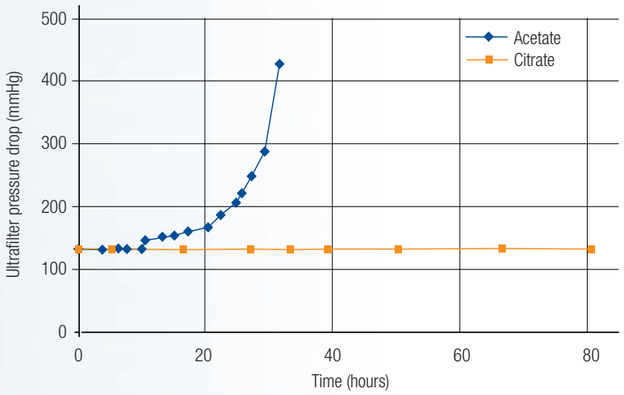
A kinetic model developed by Gambro Research shows that for each mmol/l of citrate in the dialysis fluid an additional 0.15 mmol/l of calcium is required to achieve a mass balance within the dialyzer that is equivalent to dialysis fluid without any citrate.[12,13] Clinical data support these theoretical results.[1,14]



The lines illustrate that as citrate is added to the dialysis fluid the calcium concentration needs to be increased to maintain the total calcium balance across the dialysis membrane. For a citrate concentration of 1 mmol/l, a 0.15 mmol/l higher calcium concentration achieves a calcium mass balance equivalent to fluid without citrate. Adopted from Nilsson.[12,13]

LESS CALCIUM CARBONATE PRECIPITATION

Citrate in the dialysis fluid reduces precipitation of calcium carbonates compared to conventional dialysis fluids containing acetate which might result in improved performance of the dialysis machine.[15]



Changes in pressure drop over the dialysis machine ultrafilter when run in a laboratory setting under stressed conditions with continuous flow and no decalcification [Gambro internal data on file]. Citrate dialysis fluid, unlike conventional dialysis fluid with acetate, causes no change in pressure drop over time indicating less formation of calcium precipitate in the fluid path. Adopted from Karlsson.[15]

FOR PATIENT WELL-BEING

The Gambro **SelectBag Citrate** concentrate an acetate-free dialysis fluid with all the beneficial properties of Citrate[1] is suitable for every patient.

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Every patient is different, every session is different

Individualized Quality-assured Dialysis (IQD) from Gambro helps healthcare professionals deliver the best possible care to every single patient, in every single session.

Based on leading dialysis technology and fundamental insights into chronic dialysis care, our IQD offering provides a comprehensive range of treatment modalities and dialysis products for each patient and their individual needs.

The IQD philosophy gives you the confidence that the hemodialysis session may effectively be delivered and the target dose may be consistently reached while making better use of the clinic's resources.

The IQD approach is all about making a difference in the daily lives of patients and healthcare professionals

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