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Clinical advantage of acetate free dialysate containing citrate

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Back ground

- **Dialysate for hemodialysis treatment had inevitably contained acetate, even if most of alkalizing buffer was bicarbonate. Recently, acetate free dialysate containing citrate (AFCD) has been developed.**

- **The improvement of hemodynamic conditions during hemodialysis, anemia, nutritional condition, metabolic acidosis has been reported as clinical advantages of acetate free bio-filtration (AFB).**

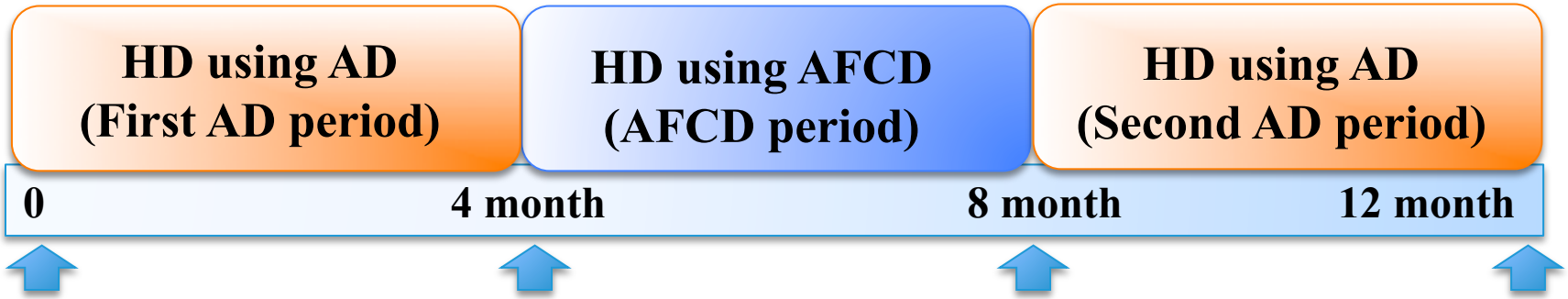
Purpose

- **For the purpose of evaluating clinical advantages of AFCD over acetate containing dialysate (AD) on acid-base balance, anemia, nutritional condition, and low int-PTH in patients with maintenance hemodialysis (mHD), dialysate for mHD was switched from AD to AFCD, and back to AD.**

Study design

Study design (A-B-A study)

29 mHD were treated with AD for 4months (First AD period). Following the AD period, these patients were treated with AFCD for the next 4 months (AFCD period) and returned to AD for the last 4 months (Second AD period) without changing other dialysis conditions (such as dialysis membrane, blood flow, dialysate flow, dosage and type of anticoagulant used) .



Measurement

Blood levels of Hb, Total protein, albumin, Urea nitrogen(UN), Creatinine (Cr), β2microglobulin(MG) , intact-parathyroid hormone(PTH), bone alkaline phosphatase (BAP), IL-6, high sensitive (h) CRP, pH, HCO_3^-, ionization (i)-calcium (Ca) levels were measured, and Kt/V and doses of ESA were evaluated before and after each period.

Characteristics of patients and dialysis conditions

Clinical characteristics

Age（yo）	61±4
Sex	male;16 female;13
Height (cm)	157±4
Weight (kg)	58±4
Etiology	DM;15 non-DM;14
Time on dialysis（year）	7±2
Hb (g/dL)	10.4±0.2
Total protein (g/dL)	6.5±0.4
UN (mg/dL)	63.9±12.9
Cr (mg/dL)	11.9±2.5
β2MG (mg/L)	26.7±5.9

Dialysis conditions

Time	3.8±0.5 hour
Frequence /week	3±0 /week
Blood flow	207±18 mL/min
Dialysate flow	500 ±0 mL/min
Dialyzer	PS：79%, PES:13%
	PMMA：4%CTA:4%

Mean ± SEM

Comparison of the composition of dialysates

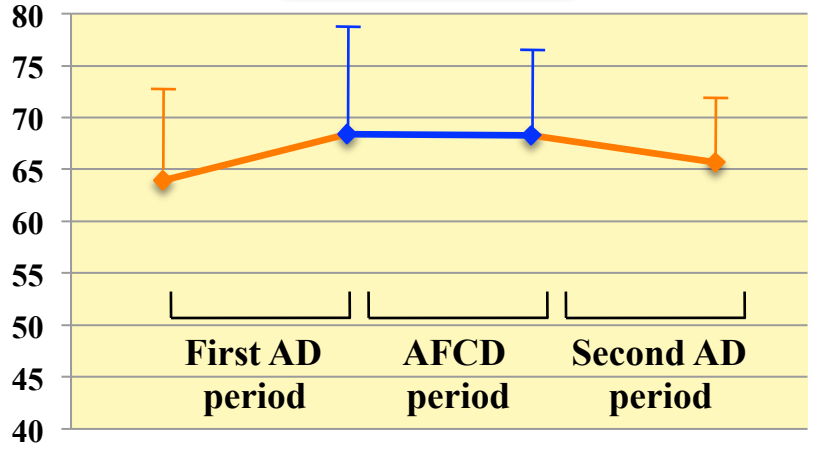
	Na (mEq/l)	K (mEq/l)	Ca (mEq/l)	Mg (mEq/l)	CL (mEq/l)
AFCD	140	2.0	3.0	1.0	111
AD	140	2.0	3.0	1.0	113

	HCO3- (mEq/l)	Acetate (mEq/l)	Citrate (mEq/l)	Glucose (mg/dl)
AFCD	35	0	2.0	150
AD	25	10	0	100

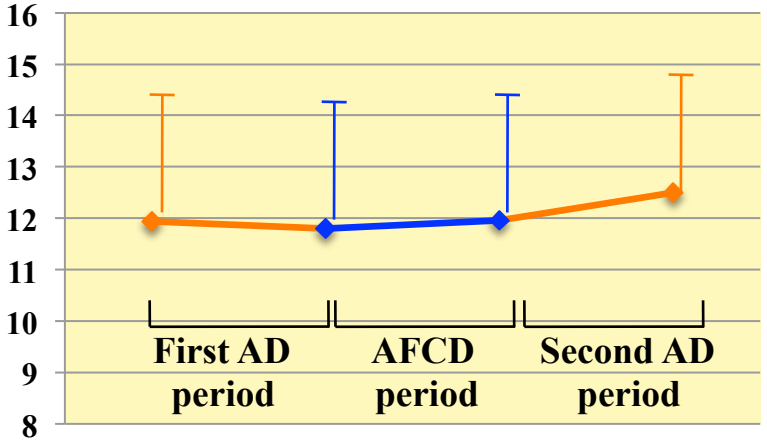
AFCD ; Carbostar ® (Ajinomoto pharma, Tokyo, Japan)
AD ; AK sortia ® (Ajinomoto pharma, Tokyo, Japan)

Changes in dialysis efficiency

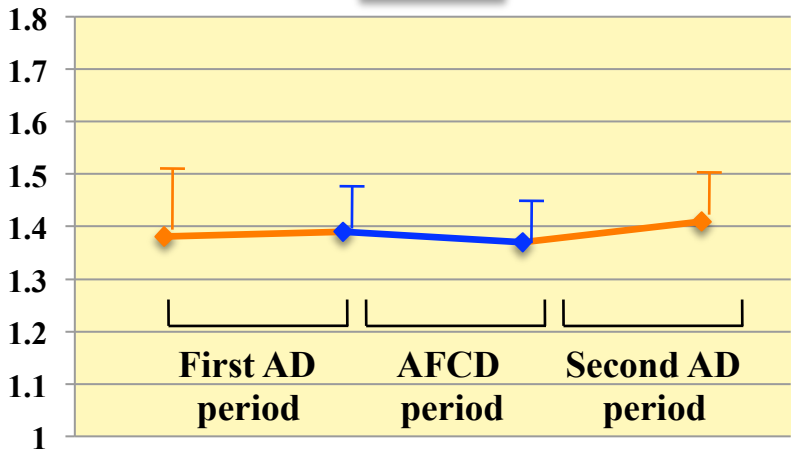
UN (mg/dL)



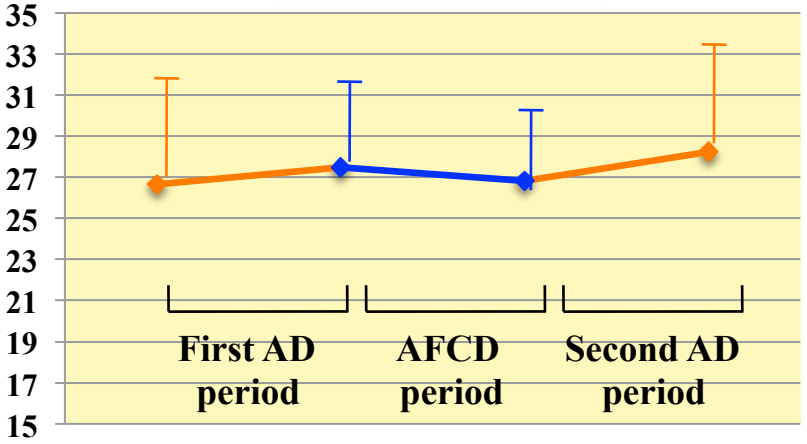
Cr（mg/dL）



Kt/V

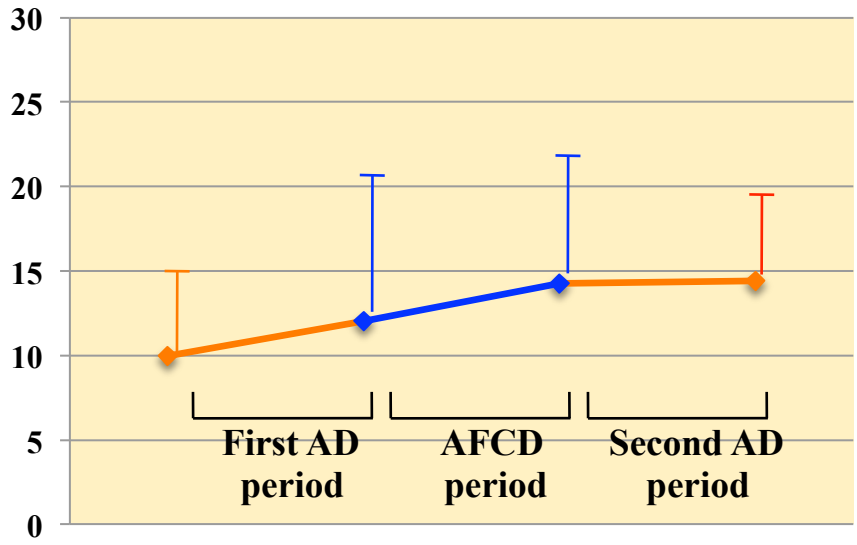


β2MG（mg/L）

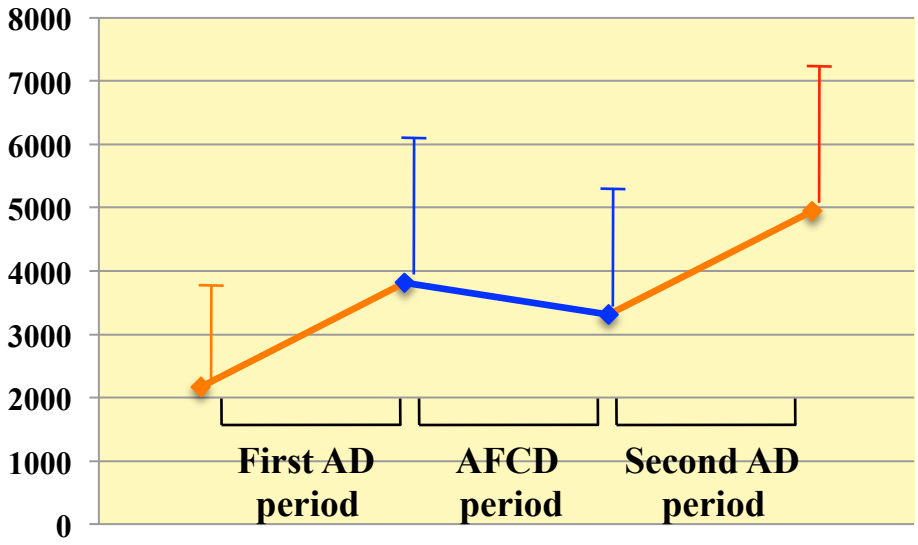


Changes in indexes of inflammation

IL-6 (pg/mL)

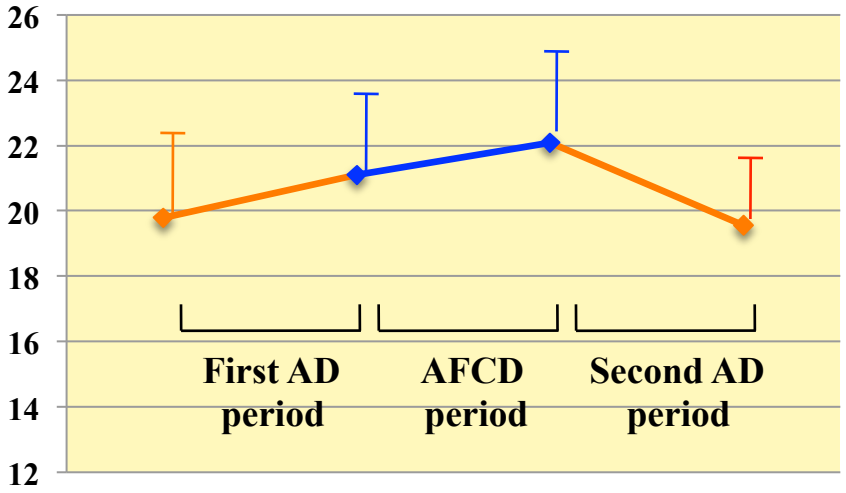


hCRP(mg/dL)

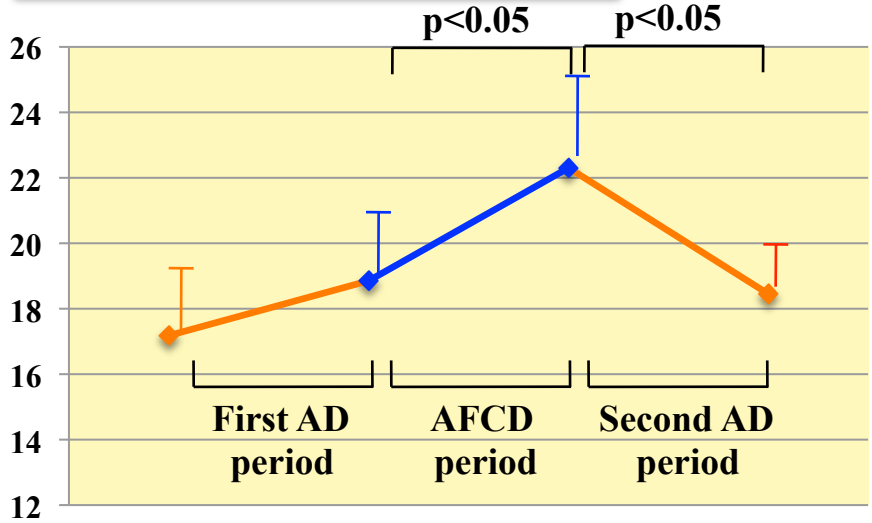


Changes in serum HCO_3^- levels

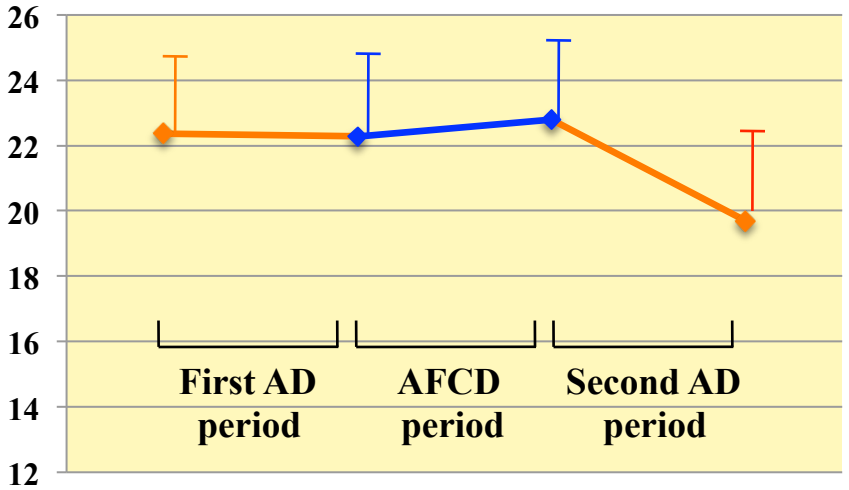
All patients (n=29)



20(mEq/L)≦HCO3$^-$ (n=16)

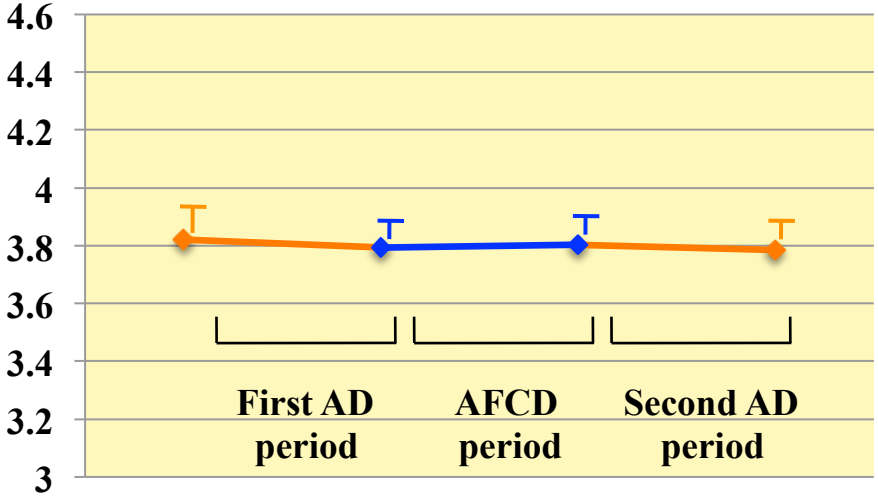


HCO3$^-$ < 20(mEq/L) (n=13)

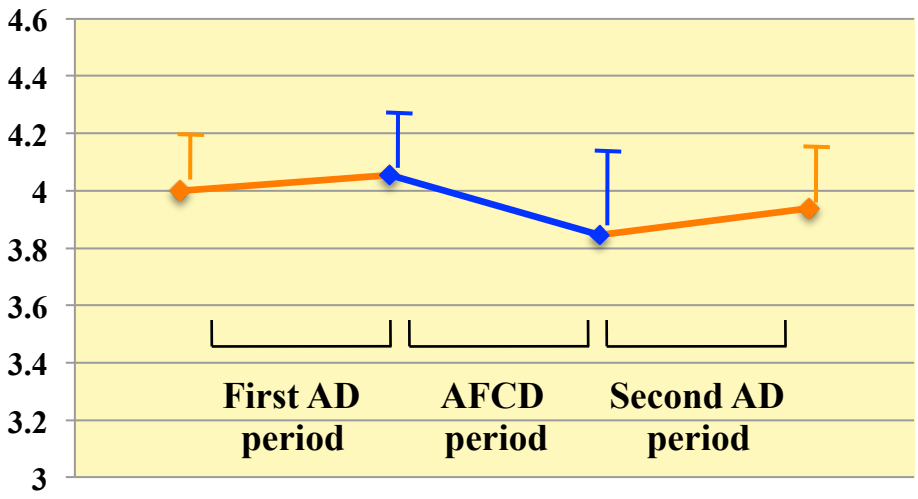


Changes in serum albumin levels

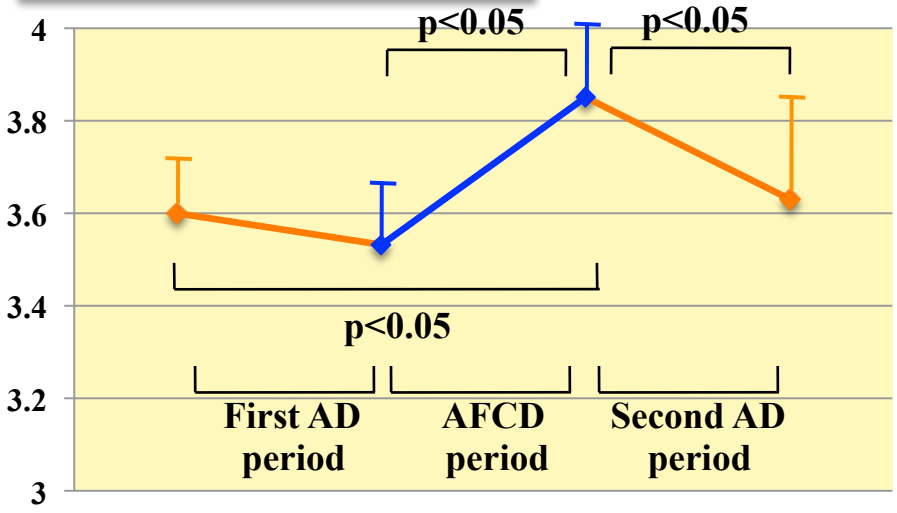
All patients (n=29)



3.8 (g/dL)≦s-alb (n=13)

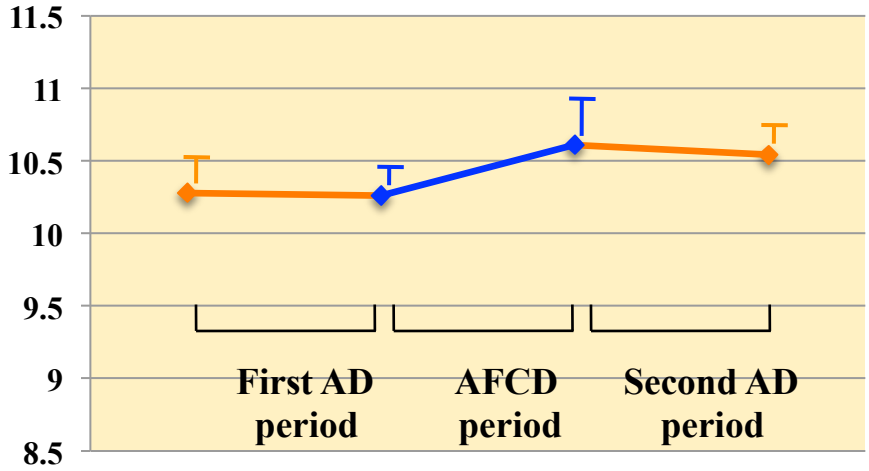


s-alb<3.8 (g/dL) (n=16)

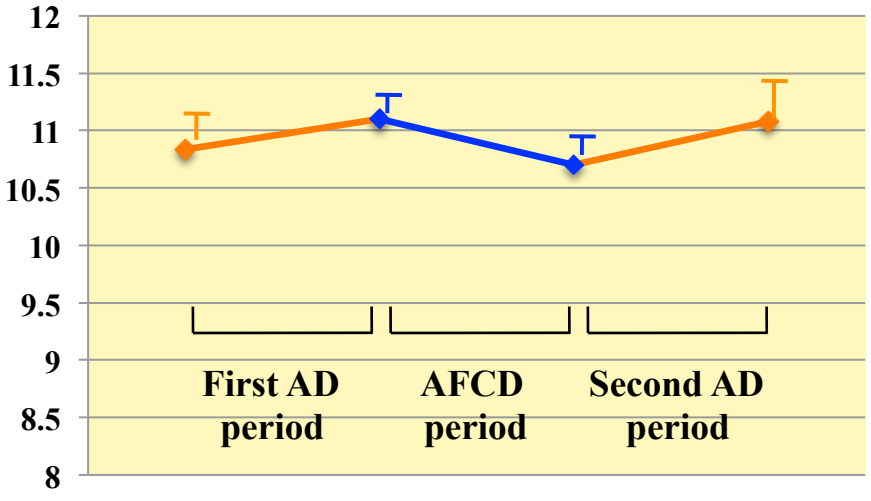


Changes in Hb levels

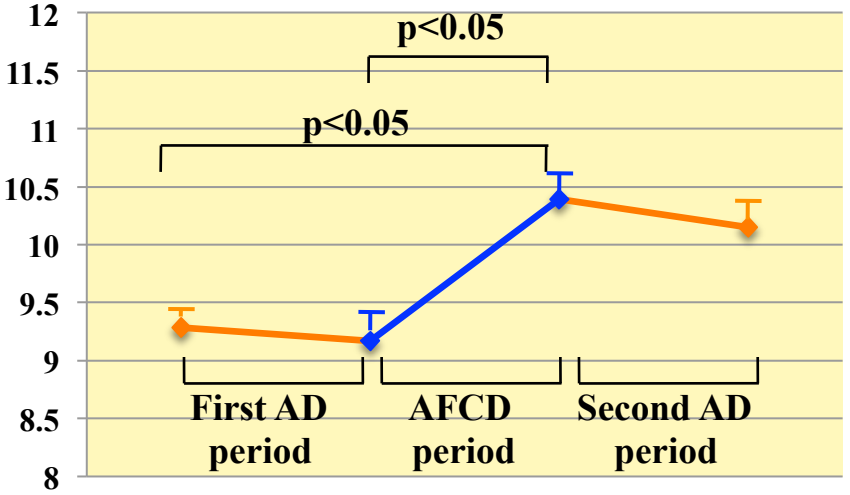
All patients (n=29)



Hb≧10 (g/dL) (n=13)

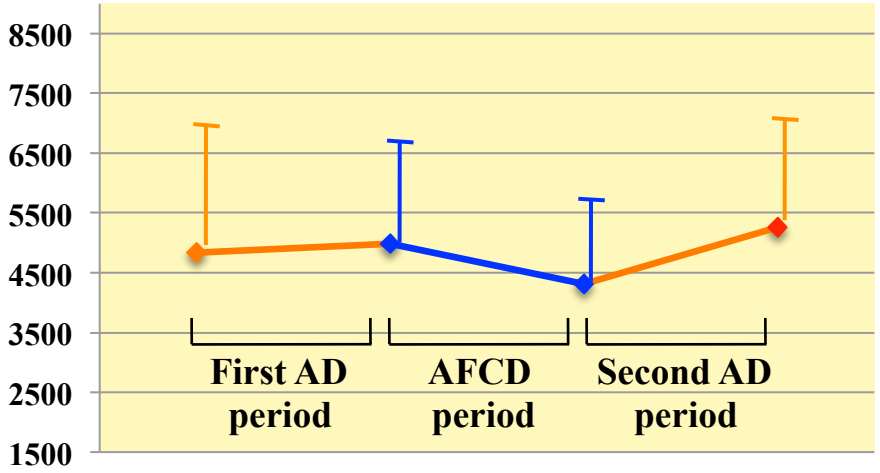


Hb<10 (g/dL) (n=16)

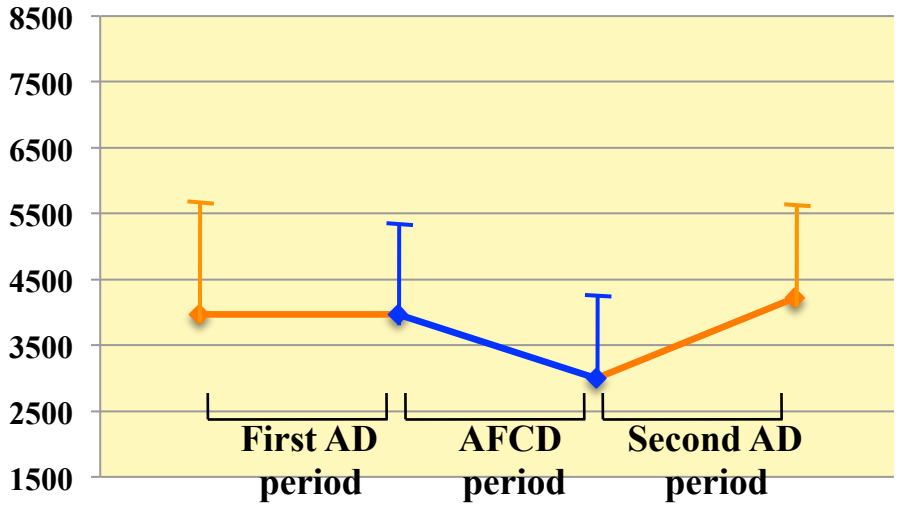


Changes in dose of ESA (IU/week)

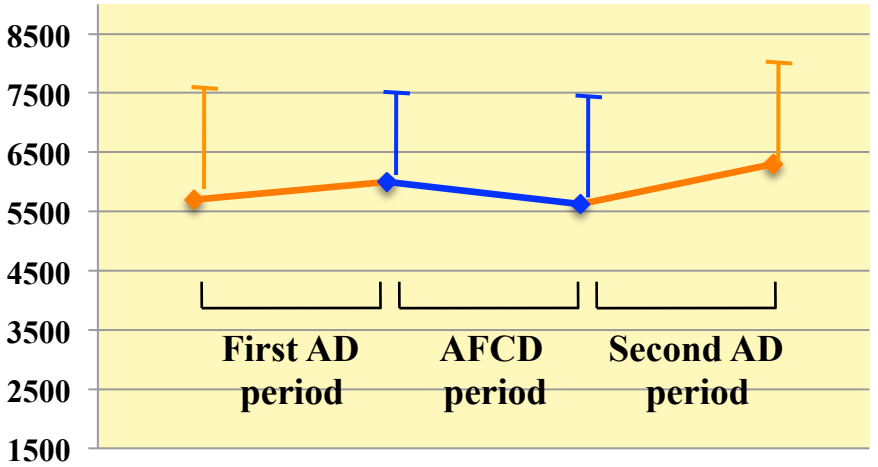
All patients (n=29)



Hb≧10 (g/dL) (n=13)

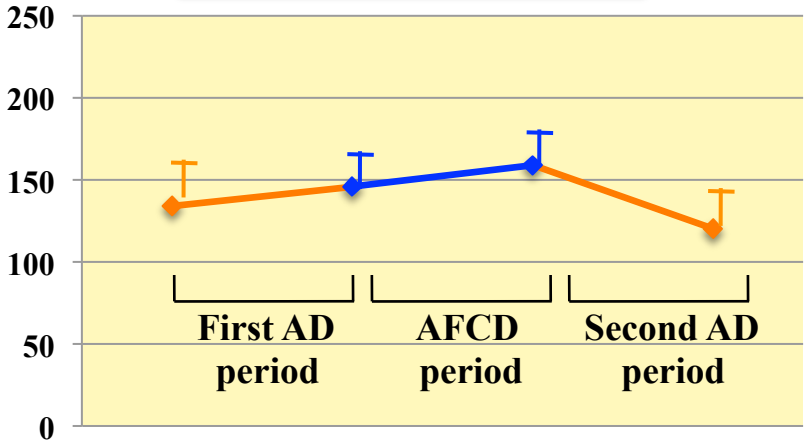


Hb<10 (g/dL) (n=16)

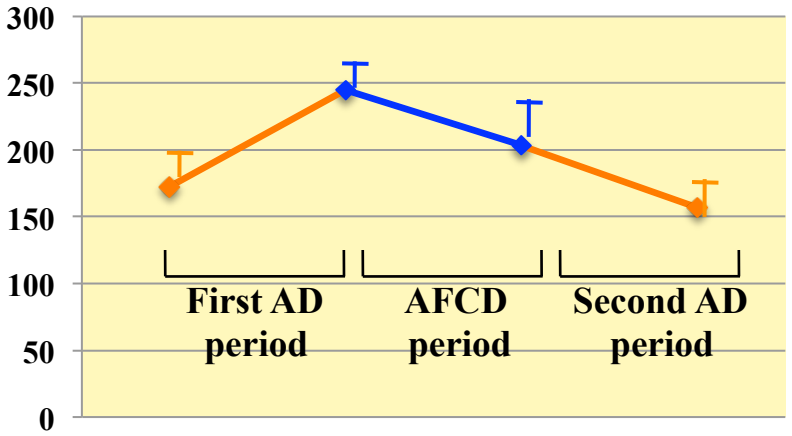


Changes in serum int-PTH levels

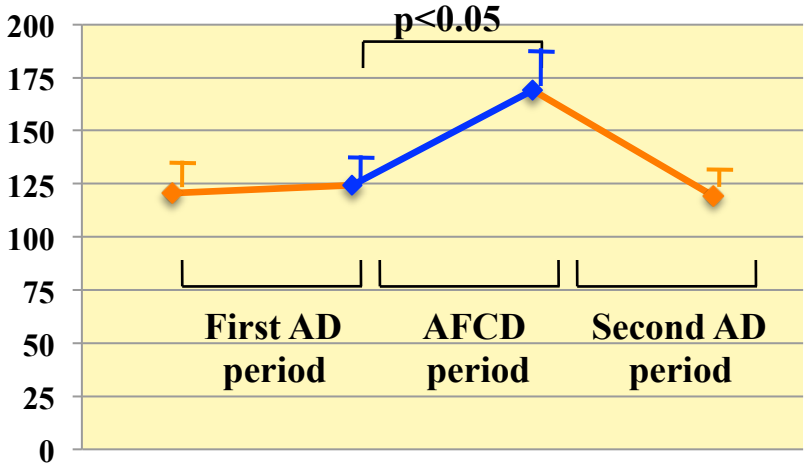
All patients (n=29)



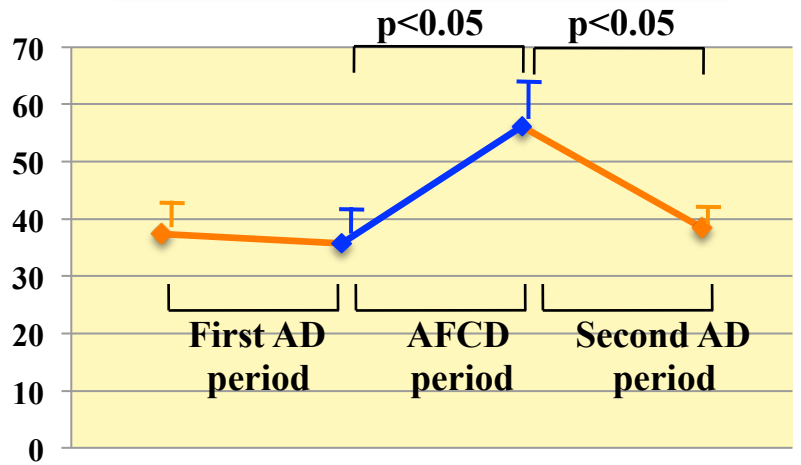
180(pg/mL)≦int-PTH (n=8)



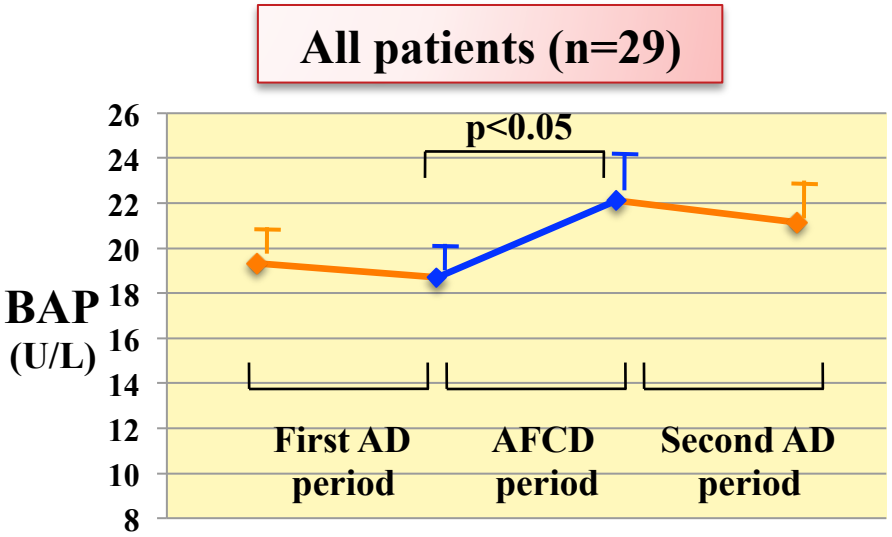
60≦int-PTH<180(pg/mL) (n=10)

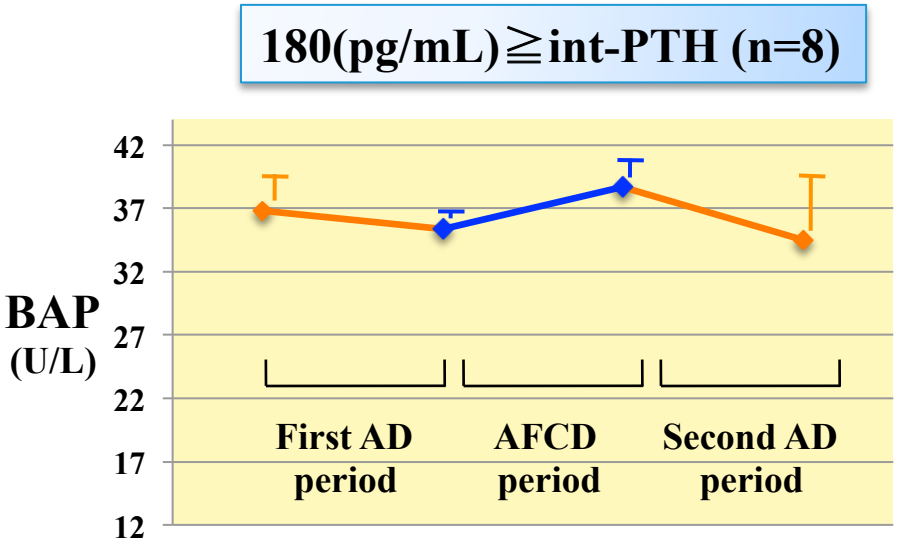


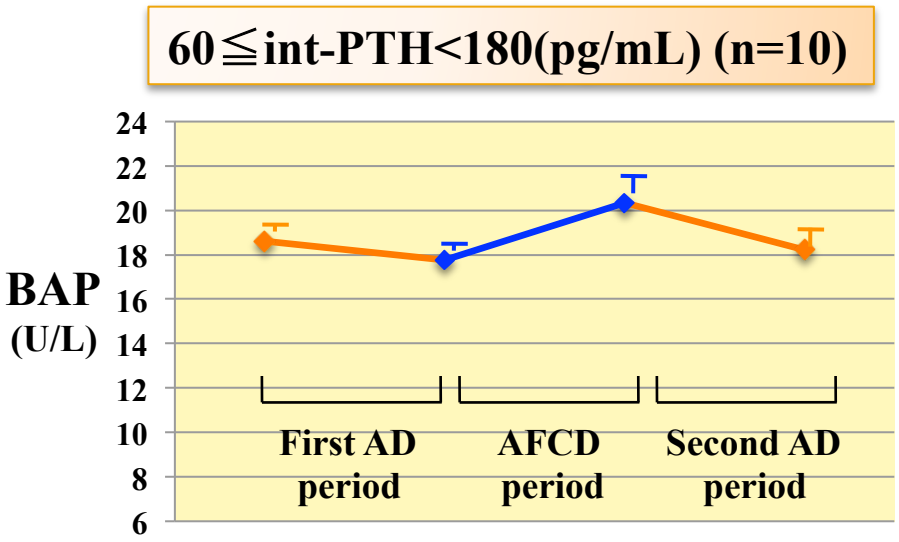
int-PTH<60(pg/mL) (n=11)

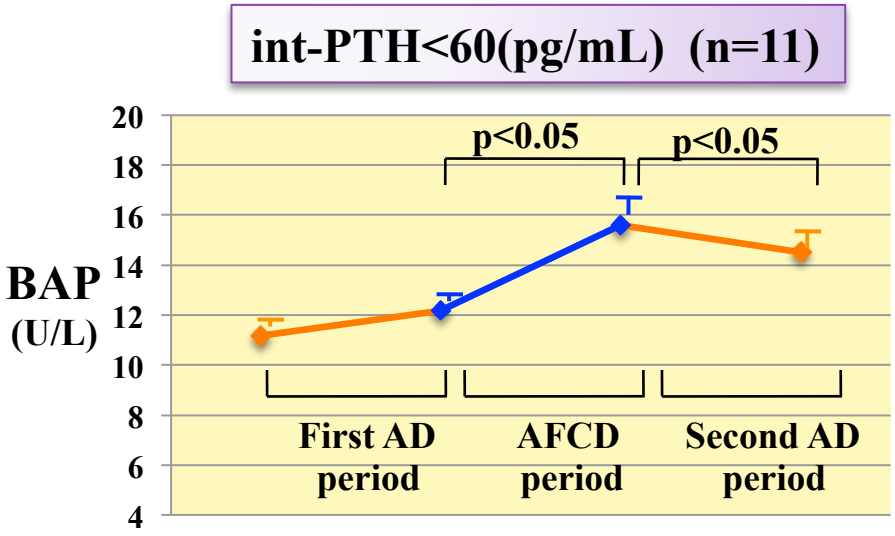


Changes in serum BAP levels



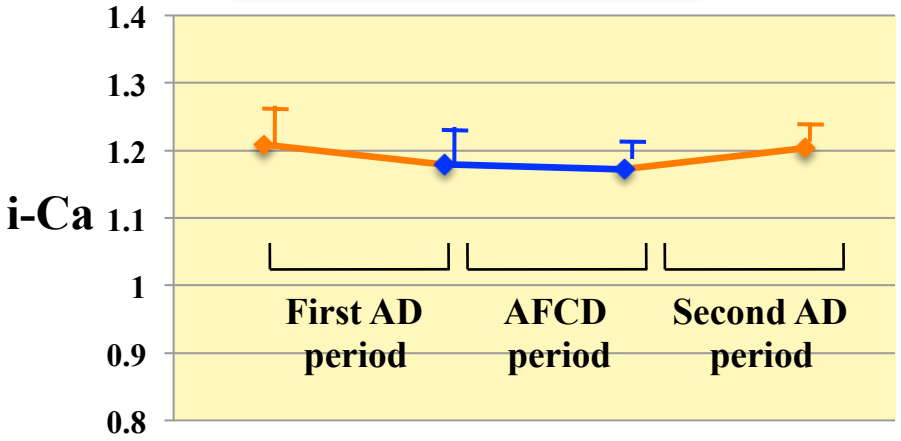




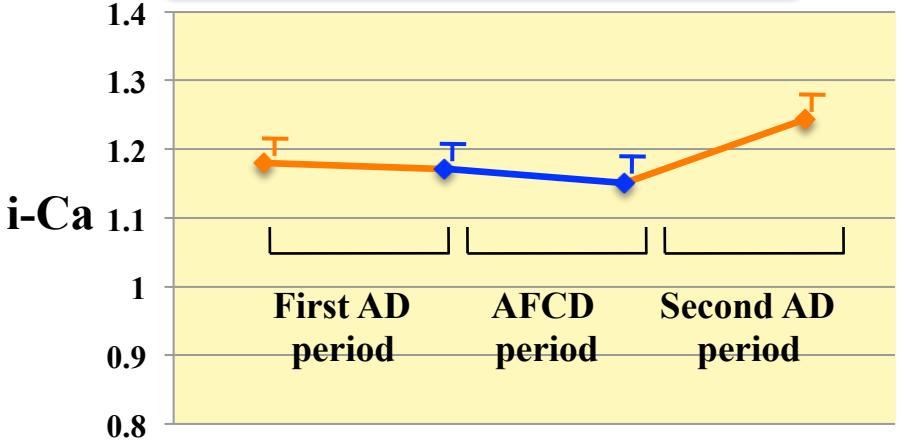


Changes in serum i-Ca levels

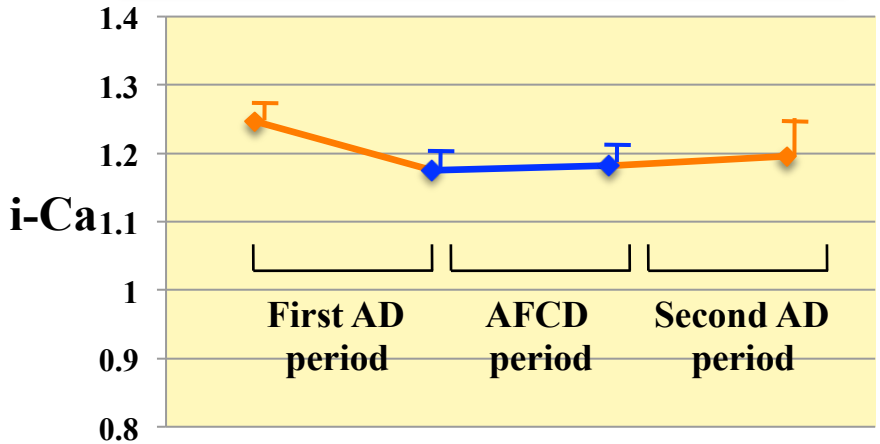
All patients (n=29)



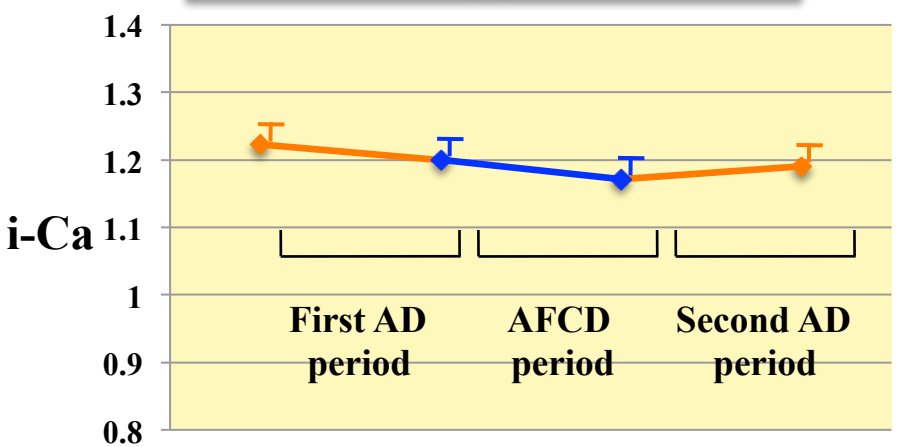
180(pg/mL)≦int-PTH (n=8)



60≦int-PTH<180(pg/mL) (n=10)

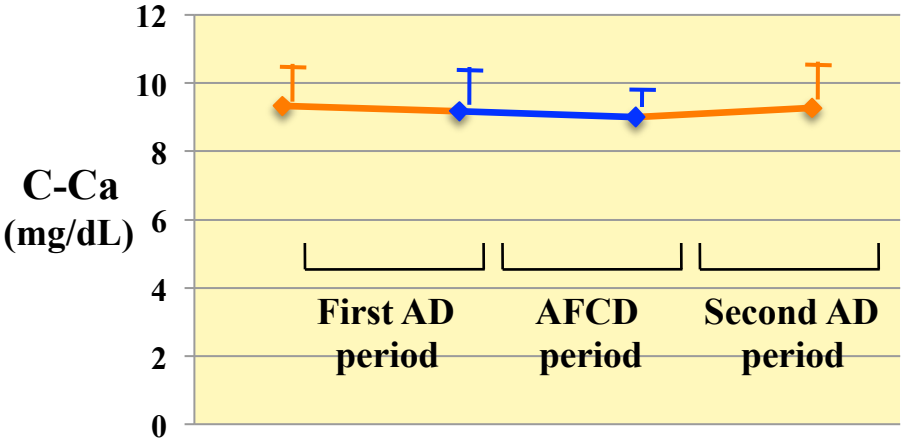


int-PTH<60(pg/mL) (n=11)

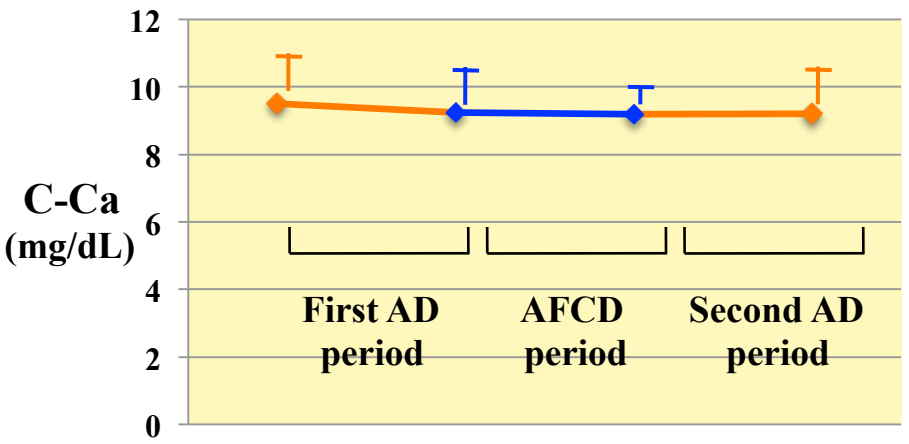


Changes in corrected Ca levels

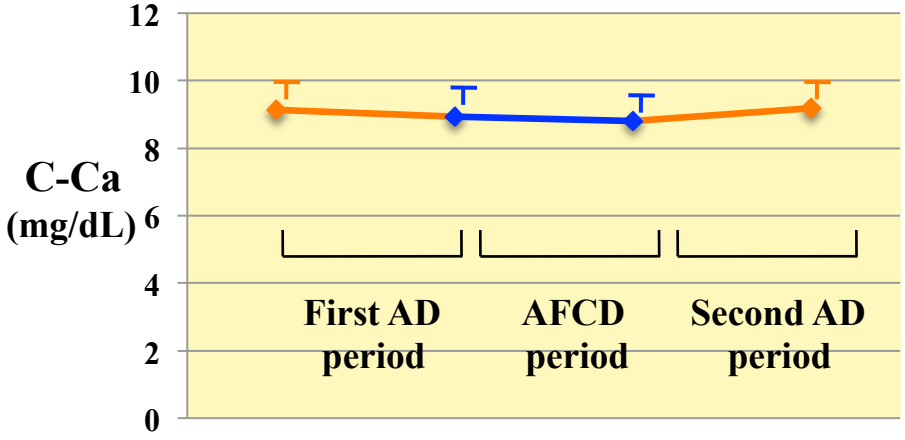
All patients (n=29)



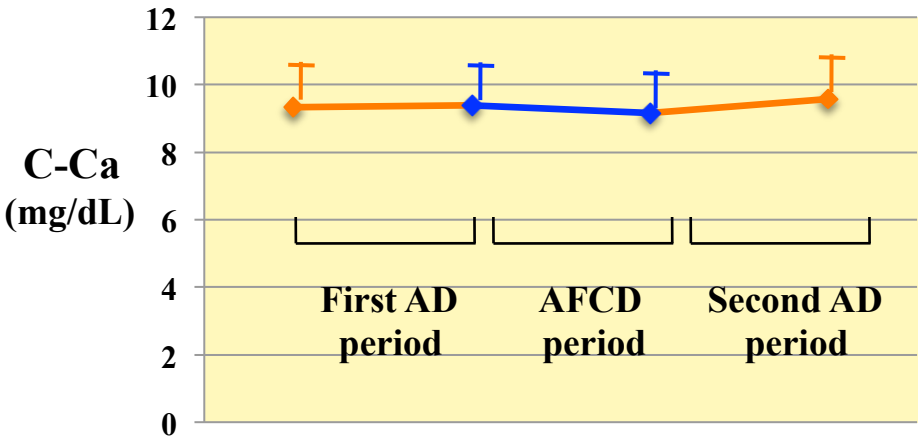
180(pg/mL)≧int-PTH (n=8)



60≦int-PTH<180(pg/mL) (n=10)



int-PTH<60(pg/mL) (n=11)



Summary of results

- **Metabolic acidosis:** In the patients with low HCO_3^- levels(<20mEq/L) , HCO_3^- was significantly increased in the AFCD period compared with first AD period.
- **Anemia:** In the patients with target Hb (≥10g/dL), the dose of ESA decreased in the AFCD period, while Hb levels were maintained during each dialysate period. In the patients with lower Hb (<10g/dL) levels, Hb levels increased significantly in the AFCD period without increasing ESA and iron dose.
- **Nutritional condition:** In the patients with lower albumin levels, serum albumin significantly increased in the AFCD period compared with the AD period.
- **PTH level:** In the patients with normal intact-PTH levels (≥60pg/mL), intact-PTH and BAP levels did not differ among the 3 periods. In the patients with hypo-parathyroidism (intact-PTH <60pg/mL), intact-PTH and BAP levels were significantly increased in the AFCD period.
- These improvements of metabolic acidosis, anemia, malnutrition, and low turnover bone disease in AFCD period were totally dissipated in the second AD period.

Conclusion

1. HD treatment with AFCD may improve the condition of patients with metabolic acidosis, hyporesponsiveness to ESA, malnutritional condition, or low turnover bone disease.

2. The most interesting finding in this study was that AFCD did not overcorrect HCO_3^- and intact-PTH.