Factors influencing Oxidation of PTH in AKI and the effects of citrate CVVH (ciCVVH)

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Introduction

AKI causes changes in calcium, phosphate, Vitamin D and PTH metabolism. Several studies have described inactivation by oxidation of PTH, mainly in CKD. However, in AKI, data are sparse.

Methods

In a study on the effects of citrate dose on calcium balance [1], we studied PTH oxidized (ox), non-oxidized (nox) and intact (i) (ox+nox) forms and factors influencing oxidation before and after 24 hours of ciCVVH for AKI.

Results

35 patients analyzed (17 to high, 18 to low citrate; male 24 (69%). Median age was 65.4 yrs (60.5-76.0). Mean APACHE II score was 30.1 at initiation (sd 5.5), median oxPTH was 192 (131-326) pg/ml, noxPTH 20 (7-31), iPTH 222 (144-382). Percentage oxidized PTH (%oxPTH) was 92% (86-96).

%oxPTH did not correlate with age, APACHE II score, phosphate, 25 hydroxy vitamin D or 1.25 dihydroxy vitamin D at baseline. OxPTH correlated with APACHE (r= 0.321, p= 0.03) only.

After 24 hours of ciCVVH median oxPTH, noxPTH and iPTH were 154 (87-217) (p=0.02), 17 (5-30) (NS) and 162 (112-258) (p=0.02) respectively.
OxPTH at 24 hours strongly correlated with phosphate (r=0.572, p=<0.001) but no other factors. Median %oxPTH did not change compared to baseline and there was no correlation with any factors.
There were no differences between citrate dose groups.
The change in %oxPTH correlated negatively with the change in phosphate over 24 hours (r=-0.419, p<0.01).

	baseline	24h ciCVVH	*significance*
oxPTH	192 pg/ml (131-326)	154 pg/ml (87-217)	*P = 0,02*
%oxPTH	92% (86-96)	90 % (82-97	*NS*
noxPTH	20 pg/ml (7-31)	17 pg/ml (5-30)	*NS*
iPTH	222 pg/ml (144-382)	162 pg/ml (112-258)	*P=0,02*

Effect of 24 hours of ciCVVH on oxidized (oxPTH), non-oxidized (noxPTH) and intact PTH (iPTH)

Conclusion

Interpretation of iPTH in AKI is complicated by oxidation to inactive oxPTH. We demonstrated oxidation rates in the AKI, higher than in healthy or CKD populations [2]. High iPTH-associated mortality in CKD populations is most likely linked to oxidative stress of which oxPTH can be a quantitative reflection [2]. Our baseline finding of a correlation between oxPTH and APACHE score could reflect similar mechanisms. Similarly, correlations with phosphate could reflect lack of metabolic control. Further, larger studies, incorporating ox- and noxPTH in the AKI population in the ICU are justified.

References:
1. Boer W. et al. BMC Nephrol. 2021 Dec 11;22(1):409. PMID: 34895160
2. Ursem S. et al. Clinica Chimica Acta 506 (2020): 84-91.