TYPE IV RENAL TUBULAR ACIDOSIS

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OVERVIEW: TYPE IV RTA

- **Most common form of RTA**
- **Normal anion gap metabolic acidosis** with **hyperkalemia**
- **Urine pH < 5.5, mild renal insufficiency**
- **Impaired ammonia synthesis → ↓ NH_4^+ excretion → Positive UAG**
- **Tubular disorder** (Chronic tubulointerstitial disease)
- **New term:** *Hyperkalemic RTA / Tubular Hyperkalemia*

ETIOLOGY

- **Chronic Tubulointerstitial Causes**
  - Analgesic nephropathy
  - Obstructive nephropathy
  - Sickle cell nephropathy
  - Lead nephropathy
  - Diabetes mellitus
- ~50% of Type IV RTA occurs in diabetic patients
- **Other Associations**
  - Chronic kidney disease
  - Primary adrenal insufficiency
- Genetic causes:
  - Congenital hypoaldosteronism (21-hydroxylase deficiency)
  - Pseudohypoaldosteronism type 2 (Gordon's syndrome)

PATHOPHYSIOLOGY

- **Hyporeninemic hypoaldosteronism** (commonest mechanism)
- **↓ Renin and/or aldosterone → ↓ distal Na^+ reabsorption → ↓ K^+ and H^+ secretion**
- **↓ Cortical collecting tubule responsiveness**
- **Impaired NH_4^+ synthesis → ↓ acid excretion**
- **Result:** Hyperkalemia + normal anion gap metabolic acidosis

URINE INDICES

- **Urine Anion Gap (UAG):**
- $(U\ Na^+ + U\ K^+) - U\ Cl^-$
- Normal: **−50 to −20 mEq/L**
- Indirect measure of **urinary NH_4^+ excretion**
- **GI HCO_3^- loss → ↑ NH_4^+ → UAG negative**
- **RTA → ↓ NH_4^+ → UAG positive**
- **Transtubular K^+ Gradient (TTKG):**
- **Low in Type IV RTA** (↓ distal K^+ secretion)

DRUG-RELATED CAUSES

- ACE inhibitors
- ARBs
- Mineralocorticoid receptor antagonists (spironolactone, eplerenone)
- Direct renin inhibitors
- β-blockers
- NSAIDs
- Calcineurin inhibitors (cyclosporine, tacrolimus)
- Heparin & analogues
- Trimethoprim, herbal preparations

MANAGEMENT

- **General Measures**
- Stop or reduce offending drugs (NSAIDs, ACEi/ARB, MRAs, etc.)
- Manage hyperkalemia: Calcium gluconate, insulin, newer K^+ binders
- Treat hyperglycemia
- Monitor ECG; temporary HD if severe
- **Specific Measures**
- **Fludrocortisone 0.1–0.2 mg/day** (selected cases)
  - Watch for HTN, edema, alkalosis
  - Avoid in volume overload or heart failure
- **Before RAASi initiation:**
  - Check eGFR, S. Cr, S. K^+
  - Review every 2 weeks initially

Type IV RTA is ***common in diabetics****,* ***potentiated by RAAS blockade****, and* ***diagnosed via UAG/TTKG*** *— respond well to* ***drug withdrawal, K^+ correction, and cautious fludrocortisone use****.*

THANK YOU