



44 yo man with hypercalcemia

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HPI

- 44 yo M with DM1 and ESRD
- DM1 since age 5
 - Poorly controlled (A1c 9.1), multiple complications, hypoglycemia unawareness
- ESRD on HD since 2007
- Simultaneous kidney-pancreas transplant 7/19/12
- Complicated by intraop SMV thrombosis->transplant pancreatectomy

HPI

- Consult for DM Management
- Transitioned from insulin gtt to SQ on POD #2
- Plan to transition back to insulin pump when mental status more stable
- Transferred back to ICU POD#4 due to HTN, abdominal pain, N/V
- Noted to have Ca 12.3

PMH

- DM1
 - Bilateral retinopathy
 - ESRD on HD since 2007 now s/p renal txp
 - HTN on 5 BP meds at home
 - CAD s/p RCA stent 2009
 - Diastolic dysfunction
 - PVD s/p LLE stent
 - Elevated transaminases due to secondary hemosiderosis
 - Benign lung nodule
-

Medications

■ Home

- ❑ Amlodipine 10 mg daily
- ❑ Coreg CR 80 mg daily
- ❑ Hydralazine 50 mg TID
- ❑ Minoxidil 5 mg am, 2.5 mg pm
- ❑ Furosemide 20 mg daily
- ❑ Fosrenol 1 tab TID
- ❑ Lipitor 20 mg qhs
- ❑ ASA 81 mg daily
- ❑ Plavix 75 mg daily
- ❑ Dialyvite daily
- ❑ Asmanex prn

■ Current

- ❑ Acyclovir 400 mg BID
- ❑ Duonebs q6h
- ❑ Coreg 37.5 mg BID
- ❑ Amlodipine 10 mg daily
- ❑ Ciprofloxacin 400 mg BID
- ❑ Flagyl 500 mg q8h
- ❑ Vancomycin 1 g q12h
- ❑ Bactrim SS 1 tab daily
- ❑ Colace 100 mg BID
- ❑ Pepcid 20 mg daily
- ❑ Cellcept 1000 mg BID
- ❑ Prednisone 40 mg daily (taper)
- ❑ Prograf 2 mg BID
- ❑ Lantus 25 units qam
- ❑ Novolog 5 units qac
- ❑ Novolog 1:30>150
- ❑ Hydralazine 5-10 mg q1-2h prn
- ❑ Dilaudid prn

Family and Social History

■ Family History

- ❑ 15 yo daughter recently dxed with DM1
- ❑ No CKD
- ❑ No known calcium disorders

■ Social History

- ❑ 10 pack year smoker, quit 2005
- ❑ Rare alcohol, no illicit
- ❑ Divorced, 4 children
- ❑ Former automotive worker

Physical Exam

- Wt 73.1 kg, Ht 175.3 cm
- T 35.7, HR 67-87, BP 165-229/68-105, RR 14-21, SaO2 88-100%
- Constitutional: Lethargic, uncomfortable
- Head: Normocephalic and atraumatic.
- Eyes: Conjunctivae and EOM are normal.
- Neck: Neck supple. No thyromegaly present.
- Cardiovascular: Normal rate and regular rhythm. No murmurs. Mild edema.
- Pulmonary/Chest: Clear to auscultation bilaterally
- Abdominal: JP drain in place with serosanguinous drainage. Decreased BS. +distension and tenderness.
- Neurological:
Somewhat confused, not answering questions appropriately.
- Skin: No rashes.

Differential Diagnosis

- Hyperparathyroidism
- Vitamin D excess
 - Increased calcitriol production
- Resorption of soft tissue calcifications
- Normalization of phosphate
- Resolution of uremia
 - Decreased PTH resistance
- Immobilization
- Malignancy

Labs

| Date | 5/2008 | 12/2009 | 3/2011 | 9/2/11 | 7/17/12 | 7/19/12 | 7/20/12 | 7/21/12 | 7/22/12 | 7/23/12 |
|------|--------|---------|--------|--------|---------|---------|---------|---------|---------|---------|
| Ca | 8.8 | 9.7 | 10.7 | 10.7 | 10.4 | 9.5 | 10.3 | 10.9 | 11.4 | 12.3 |
| PO4 | 4.1 | 4.5 | 4.2 | 6.0 | 3.9 | 5.3 | 4.0 | 3.6 | 3.1 | 2.1 |
| Cr | 6.7 | 6.9 | 7.1 | 6.9 | 9.0 | 3.5 | 2.5 | 1.7 | 1.3 | 1.2 |

- 7/23/12 PTH 373
- 25OHD 24
- 1,25OHD 13

Course

- 0.9NS increased from 83 ml/hr to 200 ml/hr
- Lasix 40 mg IV per nephrology
- Discussed cinacalcet, bisphosphonate
 - Nephrology hesitant to use either initially
- Ultimately started on cinacalcet after unable to wean off IVF

| Date | 7/23 4p | 7/23 10p | 7/24 4a | 7/24 11a | 7/24 5p | 7/24 10p | 7/25 4a | 7/25 5p | 7/26 4a | 7/27 4a | 7/27 8p | 7/28 4a | 7/29 5a | 7/30 5a |
|------|------------|-------------|------------|-------------|------------|-------------|------------|------------|------------|------------|------------|------------|------------|------------|
| Ca | 11.0 | 10.5 | 10.0 | 9.9 | 10.6 | 10.3 | 10.8 | 11.2 | 10.7 | 11.3 | 10.4 | 10.5 | 9.5 | 9.8 |
| PO4 | 2.8 | | 2.2 | | 2.2 | | 1.9 | 1.7 | 3.4 | 2.7 | | 1.9 | 1.7 | 2.5 |
| Cr | 1.0 | | 1.0 | | 1.0 | | 1.1 | 1.1 | 1.0 | 1.2 | | 1.1 | 1.1 | 1.1 |

| | | | | | | | | | | | | | | |
|---------------|-------------|---------|---------|--------|--|--|---------|----------------------------------|---------|----------------------------|--|-------------------------|---------------------------|--------------|
| ↑ | ↑ | ↑ | ↑ | ↑ | | | ↑ | ↑ | ↑ | ↑ | | ↑ | ↑ | ↑ |
| IVF to 200/hr | Lasix 40 mg | IVF 150 | IVF 100 | IVF 50 | | | IVF 100 | IVF 150, Lasix 40, IVF 200 | IVF 150 | Lasix 40, Cinacalcet 30 | | Lasix 40, Cinacalcet | Lasix 40x2, Cinacalcet | IVF d/ced |

Is furosemide first line for hypercalcemia?

- Furosemide still often recommended but evidence is questionable
- Normalization in 14/39 episodes, 2 quickly
- 40-60 mg/d did not normalize in 12 d
- Monitoring intense
- Electrolyte abnormalities
- IVF + bisphosphonate +/- calcitonin

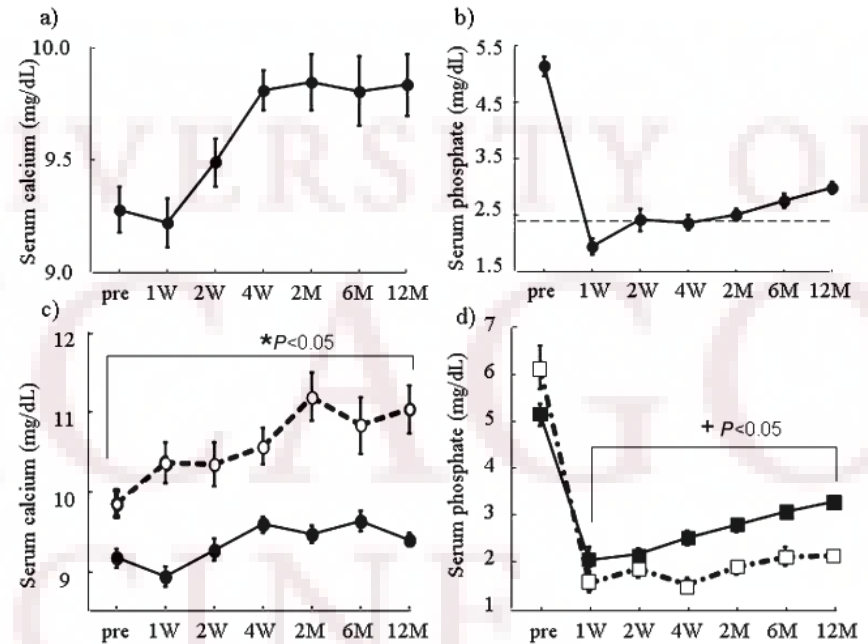
Table 1. Published Reports of Furosemide for Hypercalcemia

| Study, Year (Reference) | Study Design | Patients, n | Monitoring | IV Fluid | Furosemide Dose | Results |
|-------------------------------|--------------|--|--|--|---|---|
| Suki et al., 1970 (1) | Case series | 8 | Hourly urine output and urinary electrolyte losses | 1-2 L normal saline, then hourly | 80-100 mg every 1-2 h for 6-47 h | 3 normal, 3 near-normal, 2 reduced |
| Filastro et al., 1973 (2) | Case series | 11 | Arterial pressures and central venous pressure, urinary output, urinary electrolyte losses | Corrected dehydration first | 7 patients, 125 mg every 3 h; 4 patients, 100 mg/h | 6 normalized in 37 h-7 d, 1 unrelated death |
| Helzberg et al., 1983 (3) | Case report | 1 | Swan-Ganz catheter | Up to 39.5 L/d | 160 mg/d IV, without response; 40 mg IV x 2 after massive fluids | Normalization on day 13; could not wean from fluids, died |
| Latos and Valentine, 1973 (4) | Case report | 1 | Urinary output and urinary electrolyte losses | Replaced hourly fluid and electrolyte output | 80 mg every 2 h for 24 h, then 80 mg/h for 14 h, then 80 mg every 6 h | Normalized in 50 h; also given methylprednisolone, 80 mg, every 4 h |
| Caron, 1975 (5) | Case report | 1 | Not stated | Not stated | 160 mg over 4 h | Improved calcium, severe electrolyte imbalance, death |
| | Case series | 3 | Not stated | Normal saline, 3.5-8 L/d | 40-60 mg/d orally | Gradual decrease over 12 d (none normalized), 1 tetanic crisis from low magnesium |
| Baguet et al., 1972 (6) | Case series | 5 | ICU, hourly central venous pressure measurement, weight checked every 6 h | 1-2 L normal saline, then replacement of hourly losses | 4-160 mg every 4 h, 2-100 mg/h, 6-144 h | Only the patient with lowest initial level normalized |
| Le Gall et al., 1971 (7) | Case report | 1 (3 episodes) | Urinary output and urinary electrolyte losses | 1 L normal saline, then hourly replacement and 15 mg/h magnesium | 60-100 mg IV hourly | Episode 1, patient normalized after 12 h; episodes 2-3, levels improved but did not normalize |
| Humbert et al., 1972 (8) | Case series | 6 | Central venous pressure, urinary output every 3 h, urinary electrolyte losses every 6 h | Normal saline, then replacement of losses | 125 mg every 3 h | 3 of 6 patients normalized; furosemide doses in responders, 625-5000 mg |
| Najar et al., 1972 (9) | Case series | 3 infants (age <2 y) with vitamin D intoxication | Hourly urinary output, urine electrolyte losses every 2-4 h | 20 mL/kg, then replacement of hourly losses | 20-140 mg; 24 h treatment in 2, 48 h in 1 | 2 patients improved with rebound after 72 h—re-treated 4 times over 38 d (normalized) and twice in 7 d (not normal); 1 normalized with no rebound |

ICU = intensive care unit; IV = intravenous.

Post renal transplant hypercalcemia

- Course of post-transplant course predicted by pre-transplant calcium
- Pre-tpx PTH 399 in hypercalcemic at 12 mos vs. 204 in normocalcemic



Treatment of post renal transplant hypercalcemia: Cinacalcet

■ Journal of Nephrology 2011

- 17 renal txp pts with hyperCa 2/2 to persistent hyperpara 58 +/- 35 mos posttxp, serum Ca>10.2, PTH>150, CrCl>40
- Cinacalcet 30 mg qd, increased to 60 mg in 2 pts
- Ca 10.5->9.7 1 month->9.4 1 yr
- PTH 204.79->173.6->148.55
- PO4 2.9->3.4->3.1
- Cr 1.7->1.8->1.5

■ Hypophosphatemia?

- Dialysis patients vs. post-txp patients

Treatment of post renal transplant hypercalcemia-parathyroidectomy

- Long lifespan of parathyroid cells->slow involution
- Interstitial microcalcifications, hypophosphatemia, bone loss
- Lack of proven effect of cinacalcet on bone, expense
- Proposed indications
- Negative effect on renal function?

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