## Ca – Daily Requirements

<table>
<thead>
<tr>
<th>Age/ sex</th>
<th>Ca (mg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-3</td>
<td>350</td>
</tr>
<tr>
<td>4-6</td>
<td>450</td>
</tr>
<tr>
<td>7-10</td>
<td>550</td>
</tr>
<tr>
<td>11-18 M</td>
<td>1000</td>
</tr>
<tr>
<td>11-18 F</td>
<td>800</td>
</tr>
<tr>
<td>19 +</td>
<td>700</td>
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</tbody>
</table>
Ca – Dietary Sources

(NDC)

- Milk – 100 ml =120mg
- Cheese – 15gm = 110mg
- Yoghurt pot – 80gm = 160mg
- Other sources
  - Fish
  - Meat
  - Bread
  - Cereal
  - Broccoli
Hypocalcaemia - Causes

- Failure of secretion or actions of PTH
- Disorders of vitamin D
- CaSR disorders
- Dietary Ca deficiency (CMPI)
- Malabsorption of Ca – coeliac disease, short gut, tufting enteropathy
Hypocalcaemia – Clinical Features

- Neuromuscular excitability
- Paraesthesia (tingling sensation) around mouth, fingers and toes
- Muscle cramps, carpopedal spasms
- Tetany
- Seizures – focal or generalised
- Laryngospasm, stridor and apneas (neonates)
- Cardiac rhythm disturbances (prolonged QT interval)
- Chvostek’s and Trousseau’s signs – latent hypocalcemia
Hypocalcaemia - Investigations

- Ca and Pi
- PTH
- Vit D (25 hydroxy and 1,25 dihydroxy levels)
- Mg
- Urinary Ca/ Cr ratio
Hypocalcaemia - Approach

- Low PTH
  - Hypoparathyroidism
    - Primary/secondary
- Normal/low normal PTH
  - Mg deficiency
  - CaSR activating mutation
- High PTH
  - Vit D deficiency
  - VDDR
  - Pseudohypoparathyroidism – types 1, 2
Treatment of Hypocalcaemia

Severe Symptomatic:
- IV 10% Calcium Gluconate @ 0.11 mmol/kg (0.5 mls/kg – max 20 mls) over 10 minutes
- Continuous IV infusion of Calcium Gluconate @ 0.1 mmol/kg (Max 8.8 mmols) over 24 hours

Severe Asymptomatic:
- Oral Calcium Supplements @ 0.2 mmol/kg (Max 10 mmols or 400 mg Ca) 4 x a day
Treatment of Hypoparathyroidism

• Aim to keep serum Ca between 2.0 to 2.2 mmol/l
• Oral Calcium supplements
• Active preparations of Vitamin D
  • 1,25-dihydroxyvitamin D (Calcitriol)
  • 1-α-hydroxyvitamin D (Alfacalcidiol) @ 50 nanograms/kg (Max ~2 micrograms/day)
• Monitoring
  • Urine Ca/Cr (<0.7)
  • Renal Ultrasound Scan
Case 1 - Presentation

- TM
- 8 years
- Episodic palpitations, sweating and pallor
- TIA at 4 years age
- Referred to cardiology at RMCH – marginal prolonged QTc
- Incidental hypocalcaemia
- Father has h/o kidney stones
Case 1 - Investigations

- Ca 1.6 mmol/l, Pi 2.6 mmol/l, ALP 237
- Vit D 23 ng/ml
- PTH 6 (normal 10-70)
- Urinary Ca/ Cr ratio 0.6 initially
Case 1 - Treatment

- 1 - alpha calcidol started initially at 0.5 mcg daily
- Ca/ Cr ratio rose to 0.9 – 1.2 when Ca levels were 1.9 mmol/ l
- Diagnosis – Activating mutation of the CaSR
CaSR

- Present on the membrane of parathyroid cells
- Calciostat – regulates PTH sensitivity and response to Ca levels in serum
- Set at a “trigger” point to alter PTH secretion as guided by Ca level
CaSR mutations and effect on PTH
Case 1 – Learning Points

- In the face of hypocalcaemia, PTH value is important
- Urinary Ca/ Cr ratio monitoring is important to detect hypercalciuria – particularly after treatment is started
- In the long term, over-treatment can lead to nephrocalcinosis
Case 2 - Presentation

- 1 week old baby girl
- Frequent short seizures at home for 2 days
- Asian origin
- Breast fed exclusively
- Well in between seizure episodes
- Apyrexial, no focus of infection
- Mum had IDDM, on insulin (brief hypoglycaemia in neonatal period)
Case 2 - Investigations

- All inflammatory markers normal
- U/E, blood gas and sugar normal
- Head scan normal
- Ca 1.6, Pi 2.7, ALP 400
- PTH 15 (10 – 70)
- Urinary ca/ cr ratio 0.4
- Vit D 26
- Mg 0.49
Case 2 - Treatment

- Oral calcium supplements
- Oral magnesium supplements
- ABIDEC drops
Ca – Role of Mg

- Always measure serum magnesium in a hypocalcaemic child
- Hypomagnesemia impairs PTH secretion
- It also causes resistance to the actions of PTH at the level of kidney and bone
Case 2 – Learning Points

- Hypomagnesaemia may cause relative insensitivity of parathyroid gland to hypocalcaemia
- Optimum treatment requires adequate correction of low magnesium
Case 3 - Presentation

- 2 month old infant girl
- Consanguinity, Somalian origin
- Gastroenteritis
- Breast fed
- No seizures
- No fever
- Wide open AF and open PF
Case 3 - Investigations

- Ca 1.6, Pi 1.8, ALP 650
- PTH 434
- Vit D 0.6 ng/ml
- Mild metabolic acidosis
Case 3 - Treatment

- Oral Ca supplements until serum Ca over 2.0
- Cholecalciferol 3,000 Units daily for 6 weeks
- ABIDEC advised for 6 – 12 months
- Maternal assessment
- After treatment with oral Calcium supplements and vit D
  - PTH 400
  - Ca 2.0
  - Pi 0.4
  - 25 OH vit D 55ng/ml
Case 3 – Learning Points

- Increased awareness of vit D deficiency in breast fed infants – especially of Asian and African origin
- Routine/ opportunistic supplementation for breast fed infants with MV drops
- Maternal evaluation – likely vit D and iron deficiency
- Sibling screening as indicated – for incidental vit D deficiency/ rickets
- When PTH persistently high after initial treatment, check 1,25 dihydroxy levels too
An Approach to a Child Serum [Ca] < 2.1 mmol/l with normal serum Albumin & Mg Concentrations
Urine Ca/Cr

>0.56 mmol/mmol
Hypocalcaemic hypercalciuria

<0.56 mmol/mmol

Serum P

Low
Vitamin D related causes

Low
Serum 25 OH D

Normal
Serum 1, 25 (OH)₂ D

Low
VDDR Type I

High
VDDR Type II

Low
Vit D Deficiency

Low
Hypo-parathyroidism

High
Pseudo-hypo-parathyroidism
- Picture quiz
Autoimmune Polyglandular Endocrinopathy type 1

- Mucocutaneous candidosis
- Alopecia
- Brittle, dystrophic nails
- Intestinal malabsorption
- Autoimmune hepatitis
- Keratoconjunctivitis
- Asplenia

- Parathyroid
- Thyroid
- Adrenals
- Gonads
- Pancreatic islet cells
- Gastric parietal cells
Thank You!

Questions???