Chronic kidney disease in ARPKD

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ARPKD family information and support day 28th June 2014

Measuring kidney function

Creatinine (umol/l) : derived from muscle creatine phosphate and filtered by kidney

Glomerular filtration rate (GFR): can measure or estimate (mls/min/1.73m^2)

$$\text{Estimated GFR} = \frac{\text{Height (cm)} \times k}{\text{pCr}} \quad (\textit{Schwarz formula})$$

In the malnourished infant / child formula may overestimate the true GFR

Chronic Kidney Disease classification

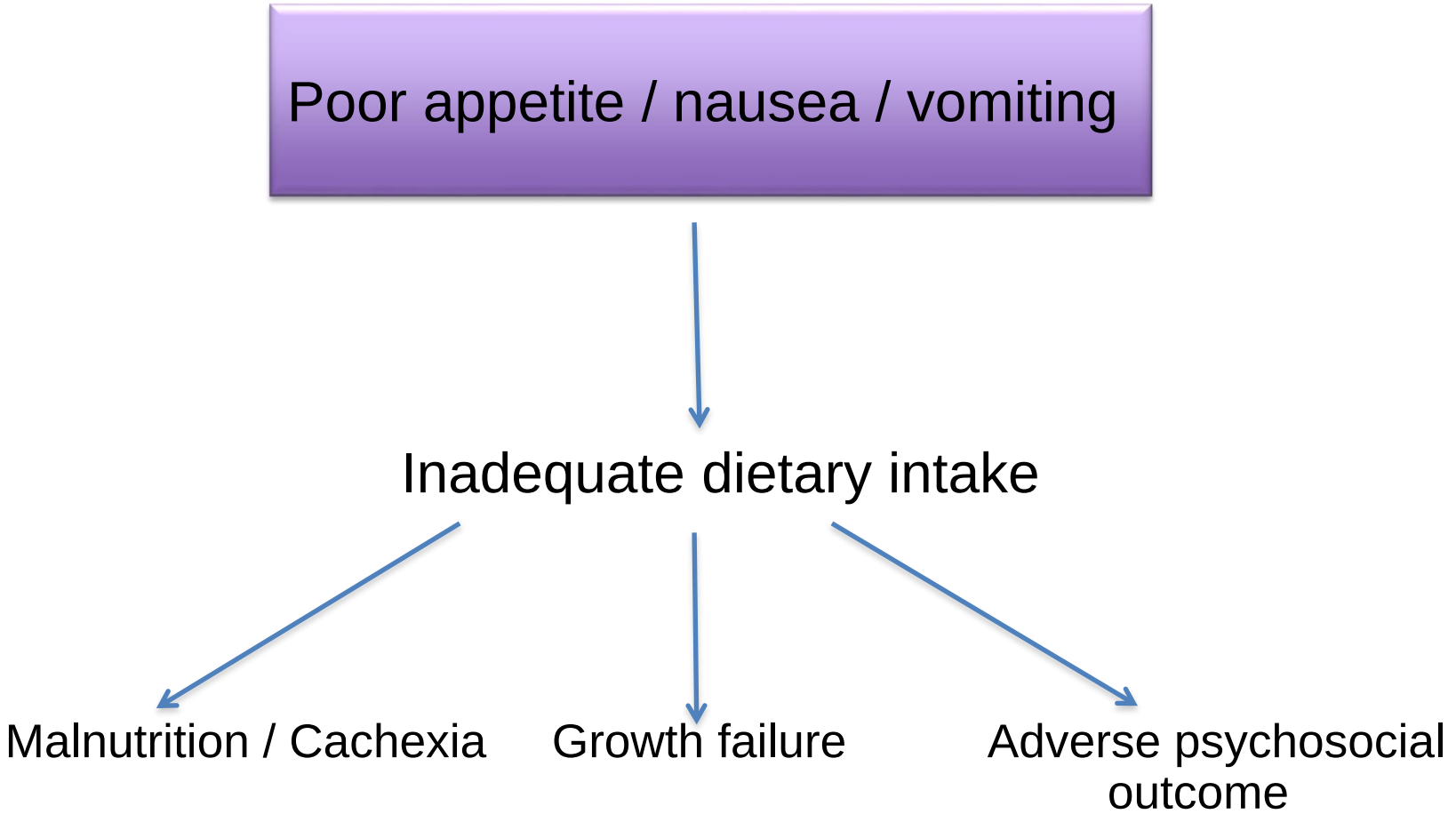
Stage	Description	GFR	Action
1	Kidney damage with normal GFR	≥ 90	Diagnosis/ treatment Slow progression Treat co morbidity Reduce CVS risk
2	Mild decrease in GFR	60-89	Estimate progression
3 A	Moderate decrease in GFR	45-59	Evaluate and treat complications
3 B		30-44	
4	Severe decrease in GFR	15-29	Prepare for renal replacement therapy
5	Renal failure	≤ 15	Start RRT

K/DOQI guidelines

CKD - management issues in ARPKD

- Growth and nutrition
- *Blood pressure control*
- Metabolic disturbance - acidosis and *salt wasting*
- CKD – Mineral and bone disorder
- Anaemia
- Infection ie urinary tract / liver
- Delaying progression – BP / proteinuria/ hydration / acidosis / hyperphosphateamia
- Neurodevelopment / psychosocial issues
- Preparation for dialysis/ transplantation

Nutrition in CKD



Why children with CKD/ ARPKD feed poorly

- *Altered appetite regulation / gastrointestinal motility/microcolon*
- *Respiratory compromise*

- Abnormal taste sensation
- Polydipsia associated with polyuria
- Disturbed feeding history
- Infections
- Multiple medications

- *Other co-morbidities*

Methods of infant feeding – oral

Encourage oral feeding- breast if possible or normal infant formula

<2 yr - whey dominant infant formula

>2 yr – whole protein based drinks / feed

- Manipulation of feeds: ↑concentration +/- carbohydrate supplements; ↓volume

- Medications
  - Prokinetic agents ie domperidone
  - H_2- receptor antagonists ie ranitidine
  - Proton pump inhibitors ie lansoprazole
  - Anti-histamine ie alimemazine

- Advice to prevent development of food aversive behaviour

Why tube feed?

- In first 12 weeks of life maximal post natal growth
  - If wt/ht static for 2/52 ↓ 1 centile
  - If wt/ht static for 4/52 ↓ 2 centiles

- After 26 weeks: 3 weeks ↓ 1 centile
  40 weeks: 4 weeks ↓ 1 centile

Failure to achieve expected growth despite dietary manipulation / medication should prompt instigation of tube feeding

EARLY INTERVENTION IS IMPORTANT

Methods of tube feeding

- Nasogastric tube

- Gastrostomy
  - percutaneous endoscopic gastrostomy (PEG)
  - radiologically inserted gastrostomy (RIG)
  - gastrostomy button (open/laparoscopic) +/- fundoplication

Feeds given as

- Bolus feeds / top-up feeds (gravity or pump)
- Overnight continuous feed with day time boluses
- Overnight feeds only
- Continuous feeds

Salt and BP in ARPKD

- Salt losses from distal dilated collecting ducts
  Need salt supplementation as low blood sodium (hyponatraemia)
- Hypertension as pressure of cysts on juxtaglomerullar cells
  Need anti hypertensive medications
- Reduced urinary concentrating ability with polyuria and polydipsia
  Need rapid rehydration / free access to H_2O
- As kidney function worsens kidney cannot get rid of water /salt
  Need to decrease salt / H_2O intake or become overloaded / need dialysis

Acidosis in CKD

Increased bicarbonate (alkali) losses
Reduced acid excretion

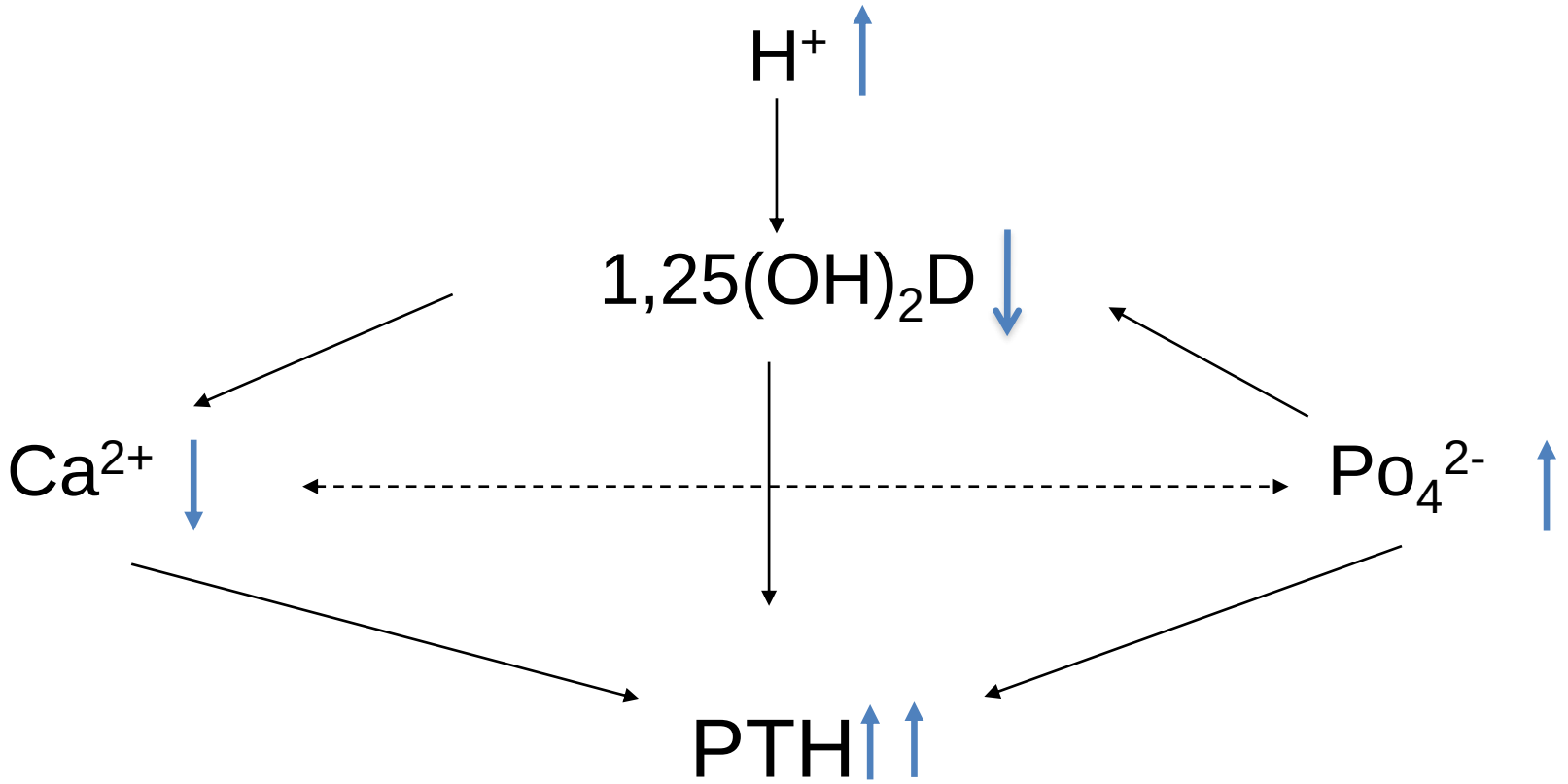
Maintain $tCo_2 \geq 22$ mmol/l with sodium bicarbonate : 1-2mmol/kg/day

- Improve nitrogen balance
- Optimise growth
- Prevent bone demineralisation
- Prevent hyperkalaemia
- Preserve renal function

CKD – Mineral and Bone Disorder

- Abnormal calcium, phosphate, parathyroid hormone and Vit D metabolism
- Abnormal bone turnover, mineralisation and growth
- Calcification of the cardiovascular system and soft tissue

CKD-Mineral bone disease



Persistent stimulation → Hyperplasia → Tertiary HPT

Management of CKD-MBD

Aims

- Maintain i-PTH normal range
- Maintain phosphate at < 50th centile for age
- Maintain normal total and ionised calcium for age
- Achieve normal bone metabolism
- Prevent vascular calcification

Methods

- Adequate supply of vitamin D
- Adequate calcium intake
- Correct acidosis
- Phosphate control by dietary restriction / phosphate binders
- Active vitamin D metabolite – lowest possible dose

Early screening / treatment to prevent parathyroid hyperplasia

Phosphate binders

- Calcium carbonate (soluble 250mg),calcichew, adcal)
- Calcium acetate (phosex, renacet)
- *Sevelamer hydrochloride (renagel) / sevelamer carbonate (renvelar)*

Match prescription to dietary intake

Monitor calcium / phosphate

Vitamin D in CKD- MBD

- Ergocalciferol (D_2) or Colecalciferol (D_3) supplement

Introduce activated vitamin D when increased PTH with controlled phosphate and meeting RNI for Vit D from feeds or supplement

- 1 alpha - hydroxycolecalciferol (alfacalcidol)

  Dose: 0.02 - 0.1 µg/kg
- 1,25 - dihydroxycolecalciferol (calcitriol)

Anaemia in CKD

Due to erythropoietin deficiency/ resistance and iron dysregulation

UK Adult and Paediatric Renal Standards 2000

Age	Hb g/dl	Evaluate anaemia
<6months	11.5 (9.5 - 13.5)	<9.5
6m-2years	12.5 (10.5 -13.5)	<10.5
thereafter	13.5 (11.5 -15.5)	<11.5

Treatment of anaemia in CKD

- Ensure adequate available iron availability and iron stores

  transferrin saturation (Fe/TIBC x 100) > 20%

  ferritin 100 - 500 mcg/l

- Exclude other causes of anaemia i.e. blood loss, inflammation (raised CRP), folate or B12 deficiency, haemolysis, haemoglobinopathy

- Erythrocyte stimulating agents (ESA's)

  Erythropoietin β ***100 - 300 u/kg/week sc***

  Darbepoietin α ***0.75mcg/kg/every 2-4 weeks sc***

Treatment of anaemia

Benefits of treatment with ESA's

- Increased energy / activity
- Improved appetite / growth
- Improved cardiac function as anaemia is a haemodynamic risk factor for cardiomyopathy (LVH)
- Reduced need for blood transfusions with risk of HLA sensitisation and infections

Dialysis and renal transplantation in ARPKD

- Peritoneal dialysis – likely to need to remove one or both kidneys

- Haemodialysis – usually will have kidneys removed

- Kidney transplant - pre-emptive ie no dialysis
  - after a period of dialysis

Live-related or deceased donor transplant

Combined kidney/ liver transplant