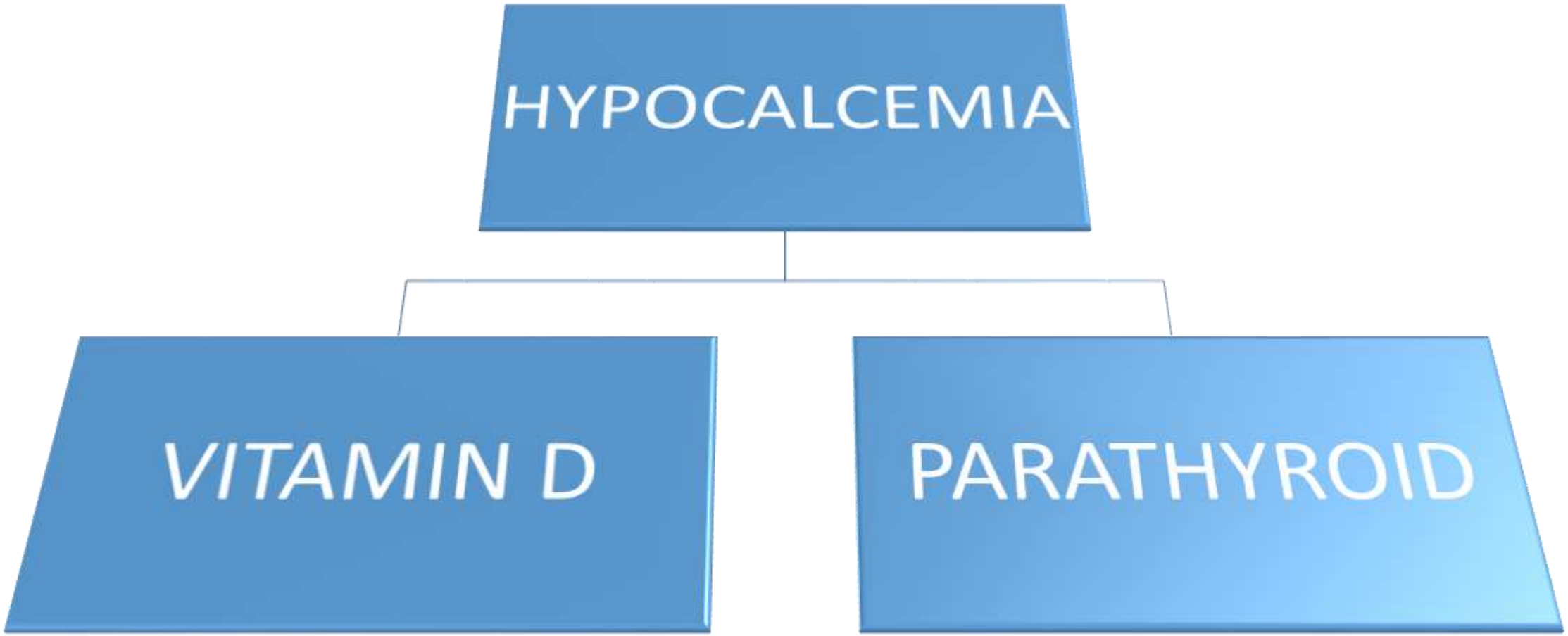
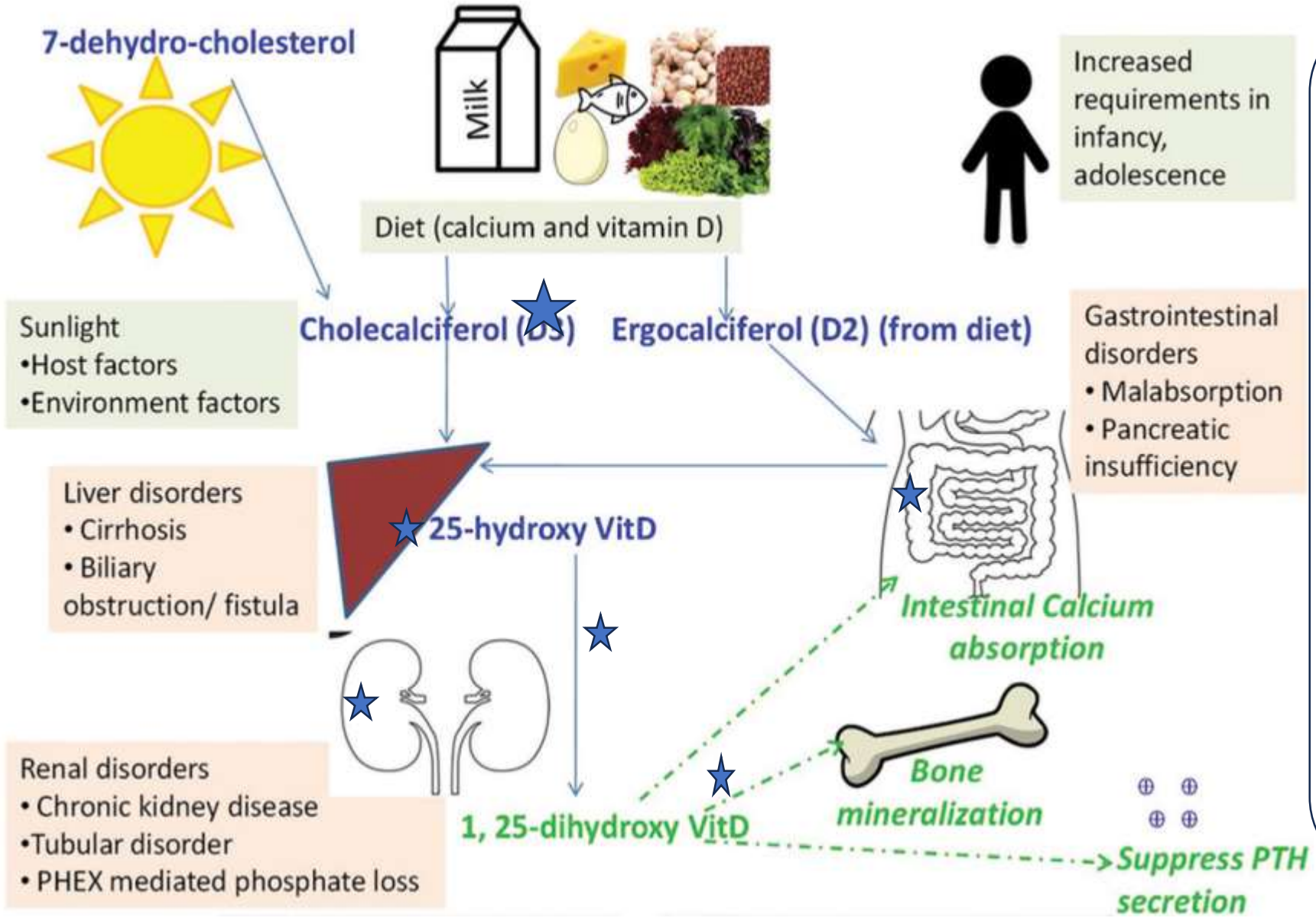
Pediatric Hypocalcaemia

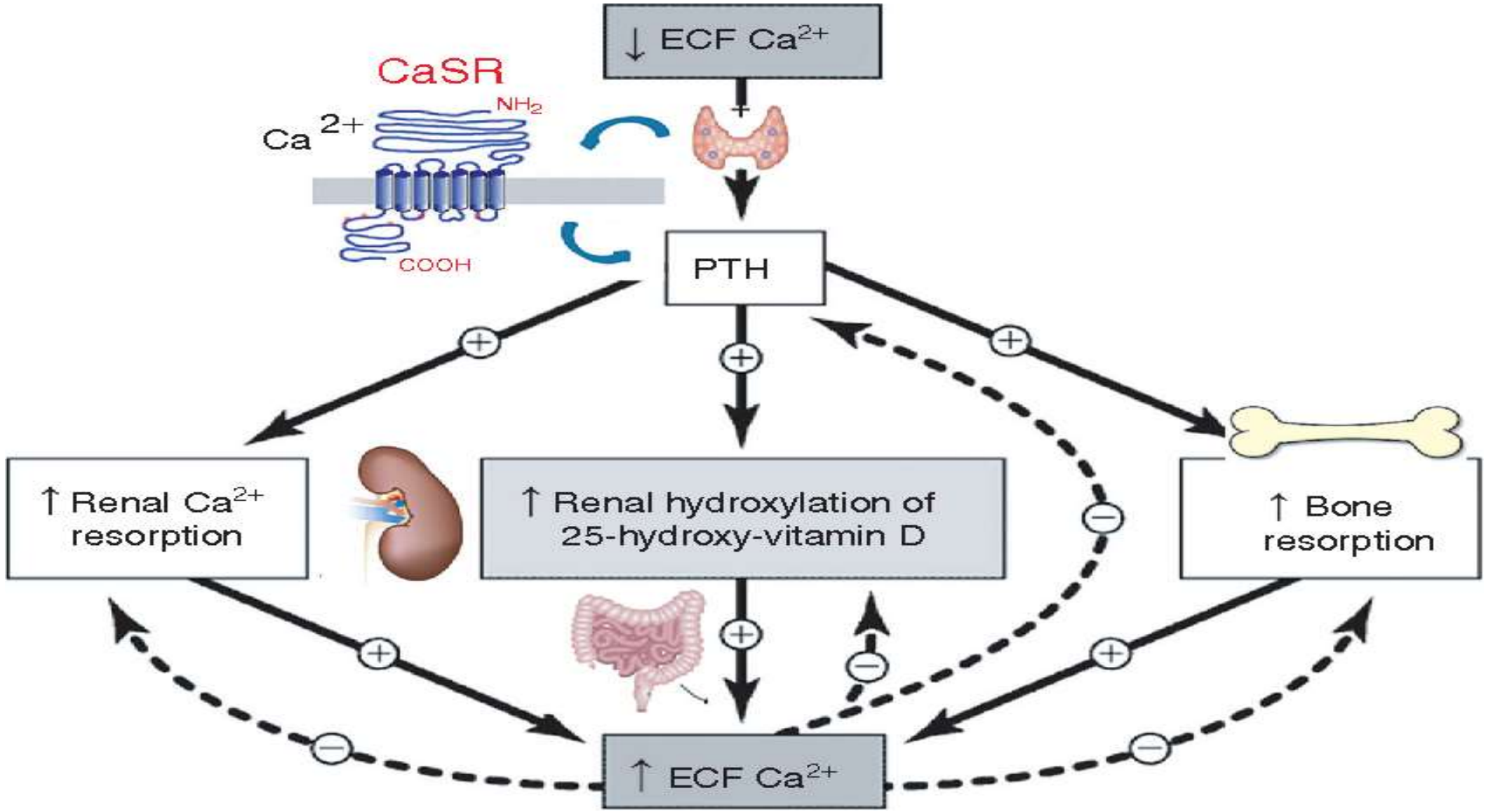
Dr.Vidhya P S

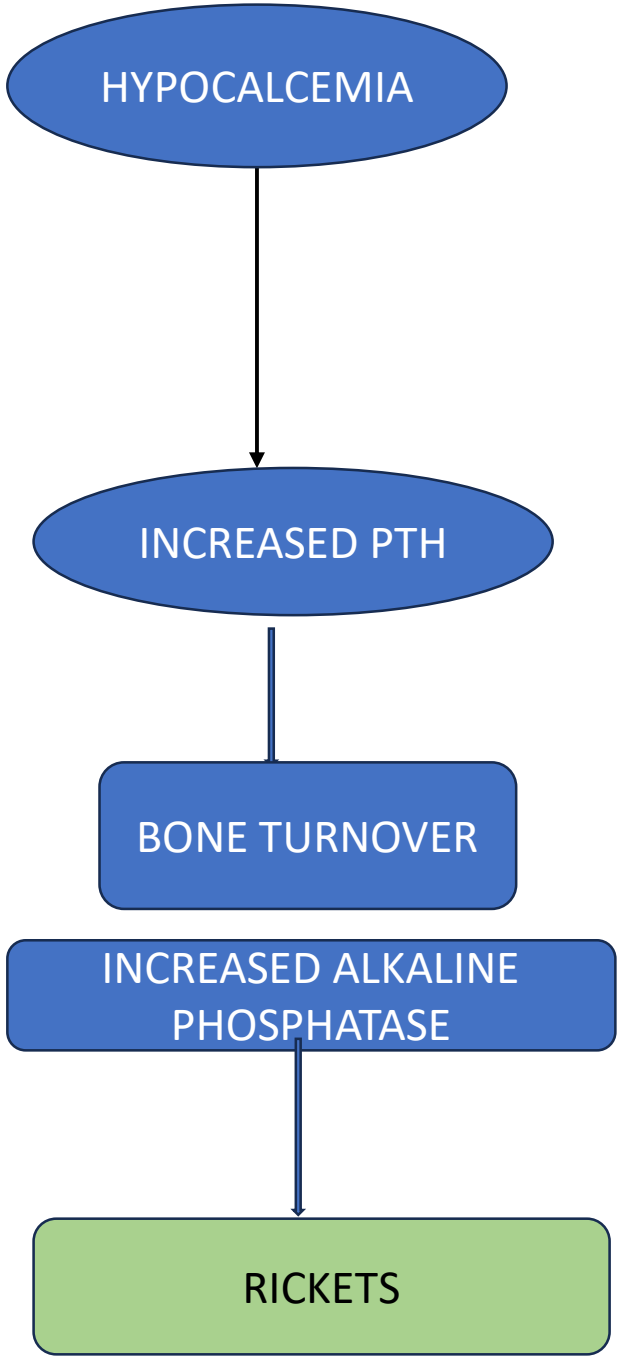

HYPOCALCEMIA
VITAMIN D
PARATHYROID

Etiology of vitamin D related Hypocalcemia



- Nutritional
- VDDR 1
- VDDR 2
- Chronic liver disease
- Gastro intestinal disorders
- Chronic renal disease


↓ ECF Ca2+
CaSR
NH2
Ca 2+
COOH
+
PTH
↑ Renal Ca2+ resorption
↑ Renal hydroxylation of 25-hydroxy-vitamin D
↑ Bone resorption
↑ ECF Ca2+



Increased PTH → decreased phosphorous
Decreased PTH → increased phosphorous

Increased PTH → decreased calcium excretion
Decreased PTH → increased calcium excretion

Case 1

2 years old male child ,hailing from Chennai, born to 3rd degree consanguineous couple, presented with complaints of progressive Bowing of legs and not able to walk. He weighs 10.5 kgs(3rd to 15th centile), and height is 80cms(<3rd centile).

He is an active child and examination shows frontal bossing, widened wrists, rachitic rosary and genu varum(bowing of legs).

Questions:

1. What are the additional history you would like to elicit?
2. What are the 1st line of investigation you would like to send?
3. What is the management of nutritional rickets?
4. When do you suspect non nutritional rickets?
5. How do you approach hypocalcemia and rickets?

HISTORY

- Pre term, LBW
- Vitamin D prophylaxis
- Sunlight exposure- urban / rural
- Diet history
- Drugs
- Malabsorption syndromes

- Consanguinity
- Family history of rickets
- Alopecia
- Dental abnormalities

INVESTIGATIONS

1ST LINE

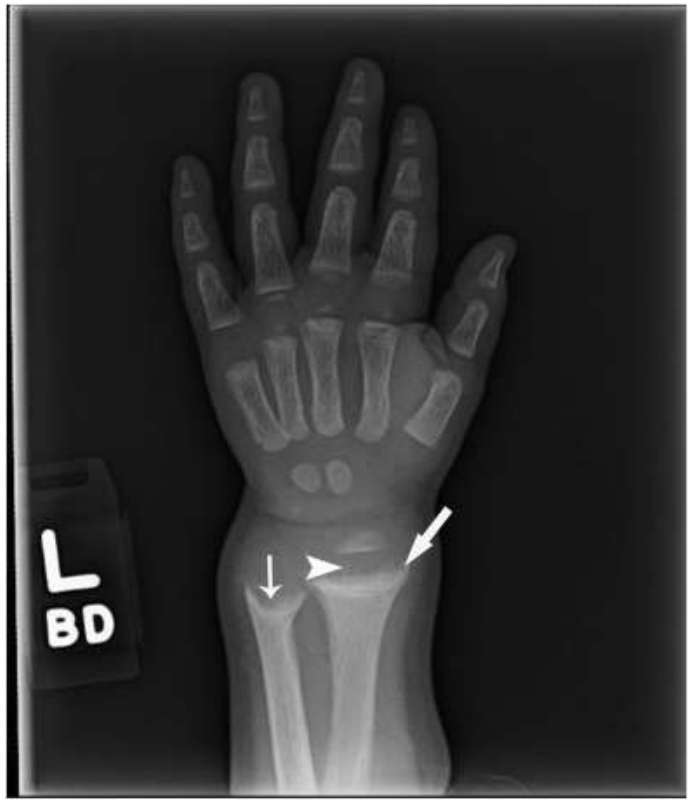
- Calcium(Albumin)
- Phosphorous
- Magnesium
- Alkaline phosphatase
- 25 OH Vitamin D
- Creatinine
- X ray wrist
- Intact PTH

2ND LINE

- 1, 25 OH Vitamin D
- Electrolytes with bicarbonate
- Urine calcium and creatinine ratio
- USG abdomen
- evaluate for bicarbonaturia, phosphaturia, glycosuria, aminoaciduria, hyperuricosuria, (Fanconi syndrome)
- Clinical Exome Sequencing (if indicated)

In our case

- Calcium :7.2mg/dl
- Albumin: 4g/dl
- Phosphorous: 3.9mg/dl
- Alkaline phosphatase: 1100 IU/L
- 25 OH Vitamin D: 28 ng/dl
- Intact PTH: 324 pg/ml
- Creatinine : 0.3mg/dl
- Magnesium 2.2 mg/dl
- X ray wrist



In our case

- 1, 25 OH Vitamin D- 115 pg/ml
- Urine calcium and creatinine ratio-0.03
- Clinical Exome Sequencing: homozygous mutation in VDR gene in chromosome 12(AR)

- DIAGNOSIS: VDDR 2A

MANAGEMENT OF NUTRITIONAL RICKETS

AGE	DAILY DOSE - 12 WEEKS	INTERMITTENT DOSE	MAINTENANCE DOSE
<6 MONTHS	2000 IU	-	400
6-12 MONTHS	2000 IU	EQUIVALENT OF 2000 IU/DAY MAY BE GIVEN ON A MONTHLY OR WEEKLY BASIS	400
>12 MONTHS	3000 IU	6000 IU FORTNIGHTLY -5 DOSES	600

MONITORING

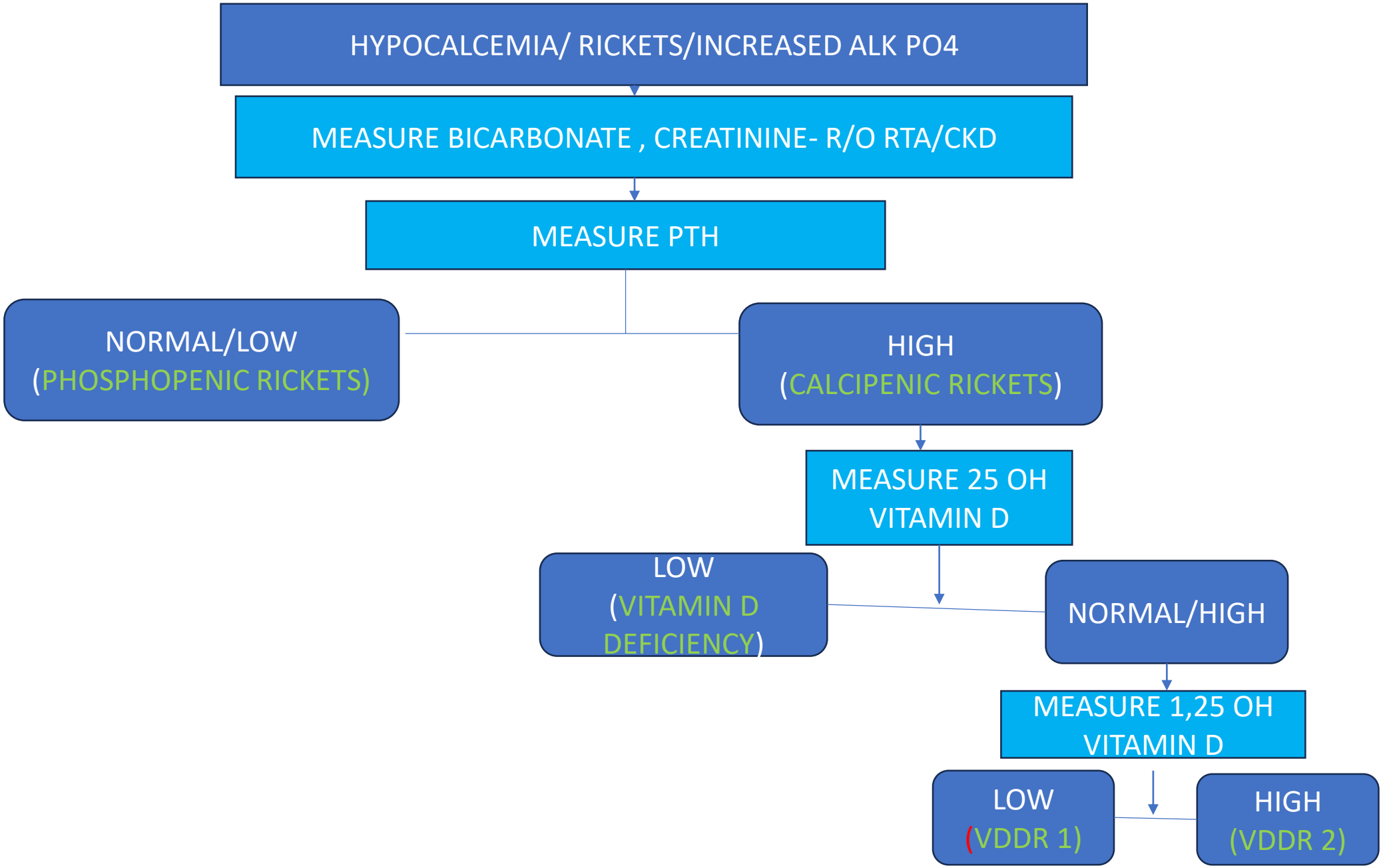
At 12 weeks: S.calcium, phosphate, Alk PO4, 25 OH Vit D

X Ray at 4 weeks and 12 weeks

NON NUTRITIONAL RICKETS

- Family clustering of cases of rickets especially in the setting of parental consanguinity
- Chronic kidney disease
- Chronic liver disease
- Malabsorption states
- Alopecia • Cataract and/or intellectual disability
- Failure to thrive with polyuria
- History of prior vitamin D intake with no clinical or laboratory improvement
- Other features e.g., jaundice, metabolic acidosis, nephrocalcinosis

APPRAOCH TO RICKETS AND HYPOCALCEMIA


HYPOCALCEMIA/ RICKETS/INCREASED ALK PO4
MEASURE BICARBONATE , CREATININE- R/O RTA/CKD
MEASURE PTH
NORMAL/LOW
(PHOSPHOPENIC RICKETS)
HIGH
(CALCIPENIC RICKETS)
MEASURE 25 OH
VITAMIN D
LOW
(VITAMIN D
DEFICIENCY)
NORMAL/HIGH
MEASURE 1,25 OH
VITAMIN D
LOW
(VDDR 1)
HIGH
(VDDR 2)

Case 2:

9 years old female child presented to ER with GTCS , preceded by history of muscle cramps and tingling around the mouth for past 1 week. Mother gives a history of mild motor and speech delay. There is no past medical illness , on normal diet and not on any medications.

On examination, she has a round face , short stubby fingers and weighs 38kgs(at 90^{th} centile) , height is 117cms(<3^{rd} centile). Her mother also appears short.

Her initial labs shows ionized calcium of 0.5 mmol/L with normal CBC and renal function tests.

Questions

1. What are the signs and symptoms of hypocalcaemia in children?
2. What are the ECG manifestations of Hypocalcaemia?
3. How will you manage acute symptomatic hypocalcaemia and chronic hypocalcaemia?
4. How will you evaluate this child?

CLINICAL FEATURES

Acute

- Paraesthesia, a tingling sensation around the mouth, fingers .
- Muscle cramps
- focal or generalised convulsions(infancy/ adolescents)
- laryngospasm, stridor and apnoea (neonates).
- Cardiac arrhythmia

SIGNS: Chvostek and Trousseau

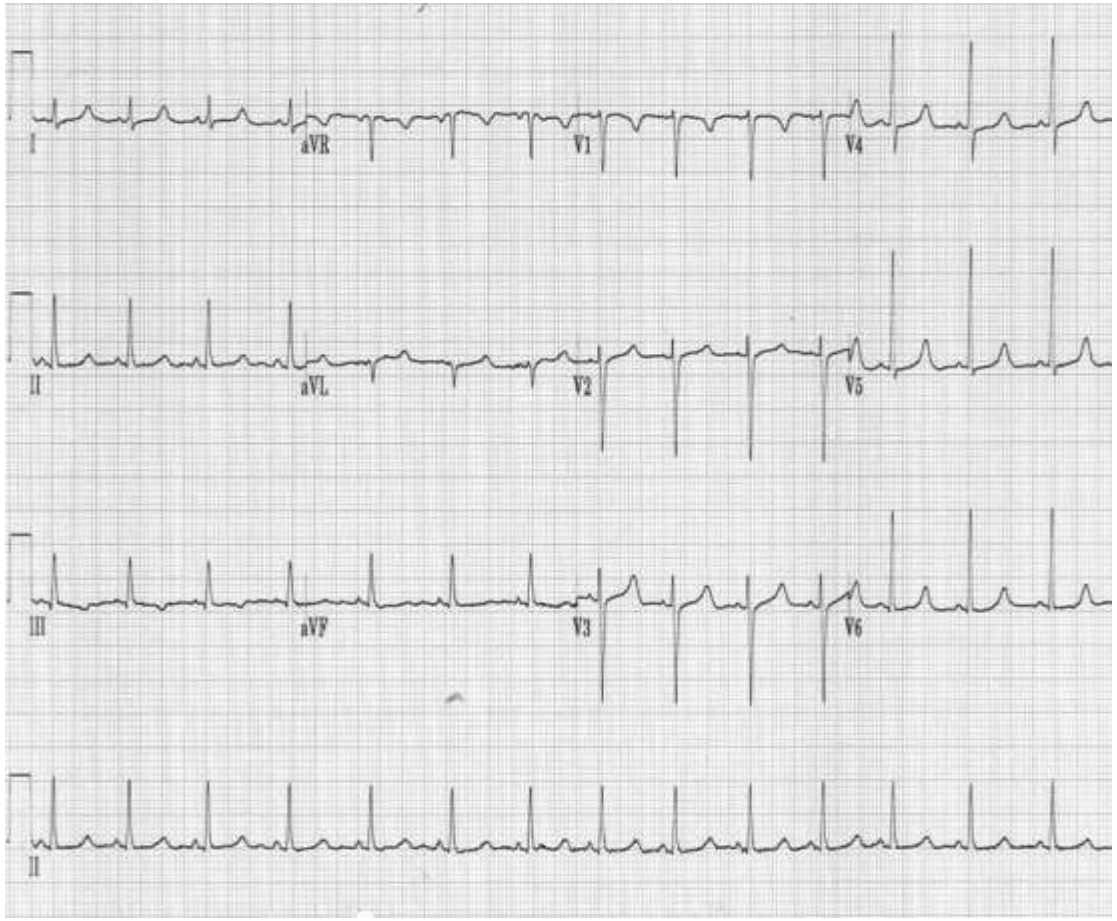
Chronic

- basal ganglia calcification, subcapsular cataracts, dental enamel hypoplasia, particularly of the primary dentition
- Short stature, rickets
- Dry skin and hair

ECG ABNORMALITIES

prolongation of the QT interval as a result of lengthening of the ST segment

Decreased T wave voltage, T wave flattening, terminal T wave inversion, or deeply inverted T waves-severe hypocalcemia



MANAGEMENT

Acute symptomatic hypocalcaemia:

(seizures, broncho- or laryngospasm, tetany, impaired cardiac contractility, and/or prolongation of the QT interval)

- 20 mg/kg elemental Ca mixed with 5%D slowly I.V over 10 to 20 min under cardiac monitoring

(2 mL/kg of 10% Ca gluconate or 0.7 mL/kg of10% Ca chloride)

Asymptomatic

Oral calcium-50 to 100mg/kg three divided dose

Hypoparathyroidism

- Calcitriol cand calcium supplemtation

Monitoring for hypercalciuria

If troublesome hypercalciuria synthetic PTH- twice daily injection or continuous infusion

VDDR 1, 2

Calcitriol and calcium supplemtation

Vitamin D deficiency

- Cholecalciferol and

Calcium supplementation

OUR CHILD

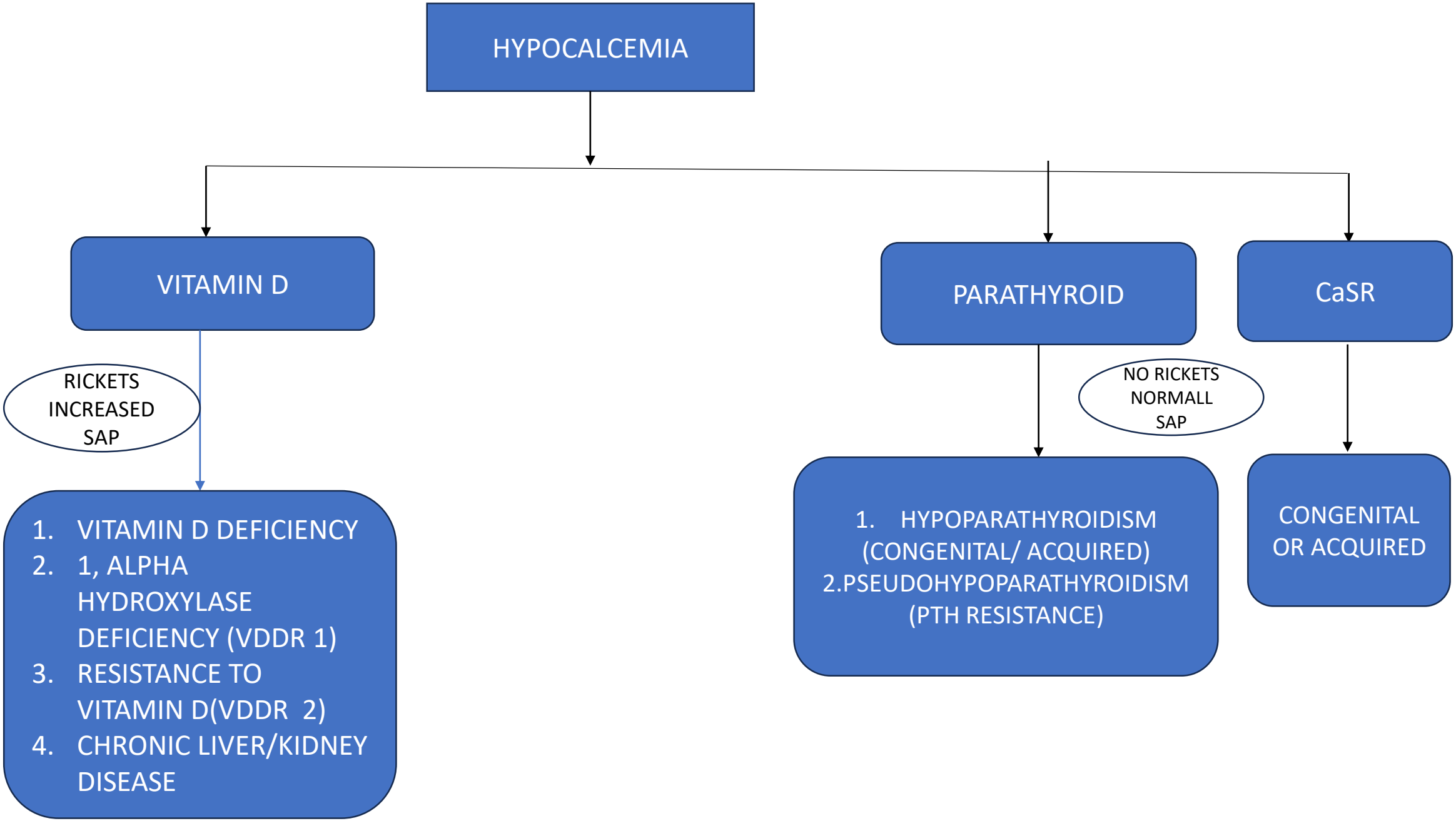
- Managed with I.V calcium gluconate and then changed to oral calcium carbonate

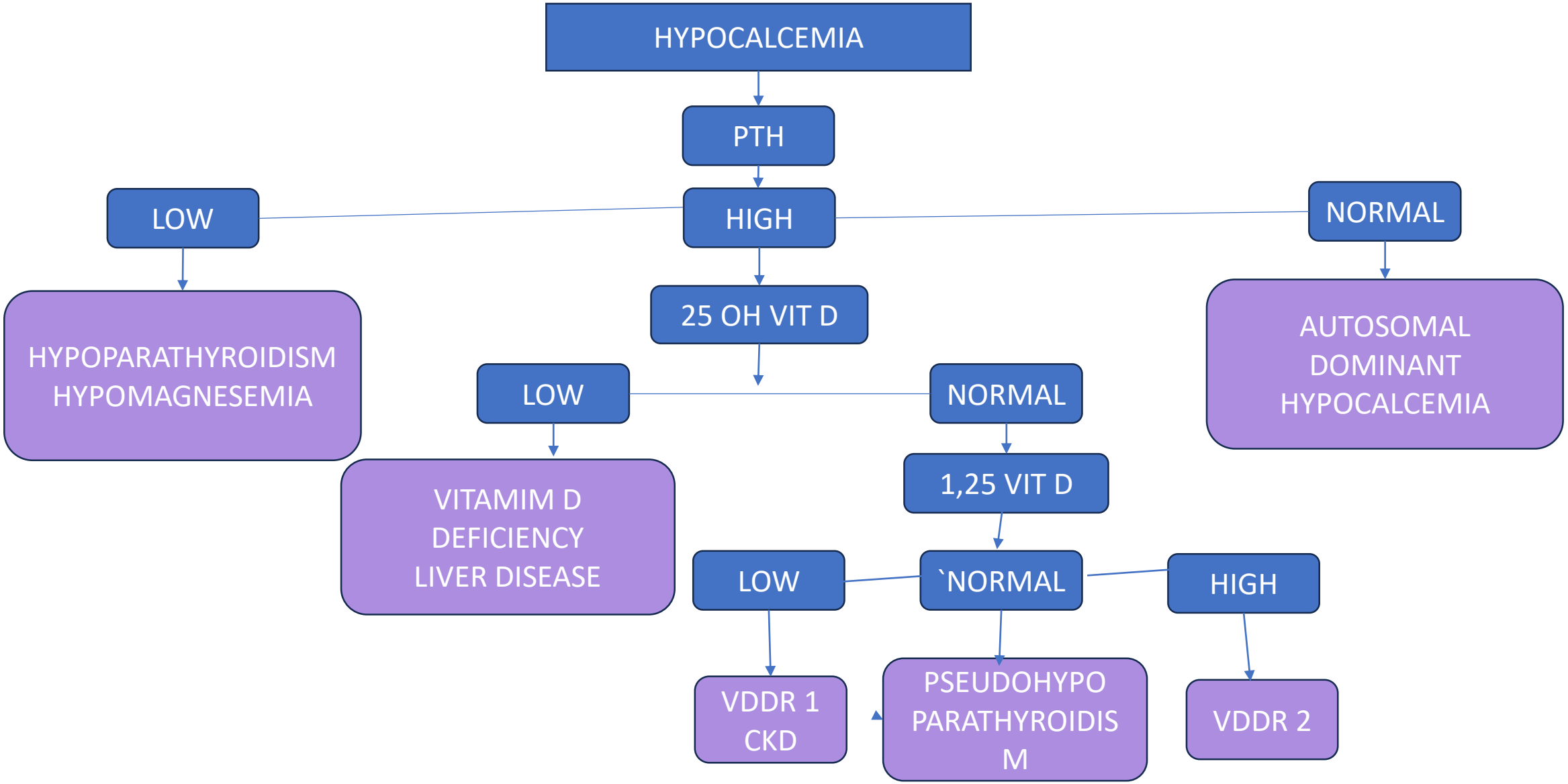
Labs:

- Ionized calcium- 0.5 mmol/L
- Po4- 5.9mg/dl
- 25 OH vitamin D-22 pg/ml
- PTH-215
- SAP- 105 IU/L
- Creatinine- 0.6mg/dl
- 1,25 OH vitamin D- 24 pg/ml
- Urine Calcium and creatinine ratio- 0.3

PSEUDOHYPOPARATHYROIDISM
TYPE 1 A
(ALBRIGHT'S HEREDITARY
OSTEODYSTROPHY)

APPROACH TO HYPOCALCEMIA


HYPOCALCEMIA
VITAMIN D
PARATHYROID
CaSR
RICKETS
INCREASED
SAP
NO RICKETS
NORMALL
SAP
1. VITAMIN D DEFICIENCY
2. 1, ALPHA HYDROXYLASE DEFICIENCY (VDDR 1)
3. RESISTANCE TO VITAMIN D(VDDR 2)
4. CHRONIC LIVER/KIDNEY DISEASE
1. HYPOPARATHYROIDISM (CONGENITAL/ ACQUIRED)
2.PSEUDOHYPOPARATHYROIDISM (PTH RESISTANCE)
CONGENITAL OR ACQUIRED


HYPOCALCEMIA
PTH
LOW
HIGH
NORMAL
HYPOPARATHYROIDISM
HYPOMAGNESEMIA
25 OH VIT D
AUTOSOMAL
DOMINANT
HYPOCALCEMIA
LOW
NORMAL
VITAMIM D
DEFICIENCY
LIVER DISEASE
1,25 VIT D
LOW
`NORMAL
HIGH
VDDR 1
CKD
PSEUDOHYPO
PARATHYROIDIS
M
VDDR 2

EXERCISE

DISEASE	CALCIUM	PHOSPHOROUS	ALKALINE PHOSPHATASE	PTH	25 OH VIT D	1,25 OH VITD
NUTRITIONAL	low	Low/normal	high	High	low	low
VDDR 1	low	Low/normal	high	High	normal	low
VDDR 2	low	Low/normal	high	High	normal	high
HYPOPHOSPHATEMIC RICKETS	normal	low	high	Normal/Mild elevated	normal	normal
HYPOPARATHYROIDISM	low	High	normal	low	normal	Normal or low
PSEUDO HYPOPARATHYROIDISM	low	high	normal	High	normal	normal
CaSR mutation(FHH)	low	high	normal	normal	normal	Normal
CHRONIC KIDNEY DISEASE	low	high	high	high	normal	low
HYPOMAGNESEMIA	low	normal	normal	low	normal	normal

THANK YOU