

The background features a gradient from purple at the top to blue at the bottom. It is decorated with various circular and semi-circular patterns, some with arrows indicating direction. A prominent scale on the left side shows numerical values from 140 to 260 in increments of 10. The main title is centered in a large, bold, black serif font.

METABOLIC ALKALOSIS

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Chloride responsive

Gastric losses
Emesis
Nasogastric suction
Diuretics (loop or thiazide)
Cystic fibrosis
Chloride-losing diarrhea
Low chloride formula
Post hypercapnia

Chloride resistant

High Blood Pressure	Normal Blood Pressure
Cushing syndrome Adrenal adenoma/ hyperplasia Glucocorticoid-remediable aldosteronism Renovascular disease Renin-secreting tumor 17 α -Hydroxylase deficiency 11 β -Hydroxylase deficiency 11 β -Hydroxysteroid dehydrogenase deficiency Licorice ingestion Liddle syndrome	Bartter syndrome Gitelman syndrome Autosomal dominant hypoparathyroidism EAST syndrome Base administration

Metabolic alkalosis

Chloride responsive

Gastric losses

Emesis

Nasogastric suction

Diuretics (loop or thiazide)

Cystic fibrosis

Chloride-losing diarrhea

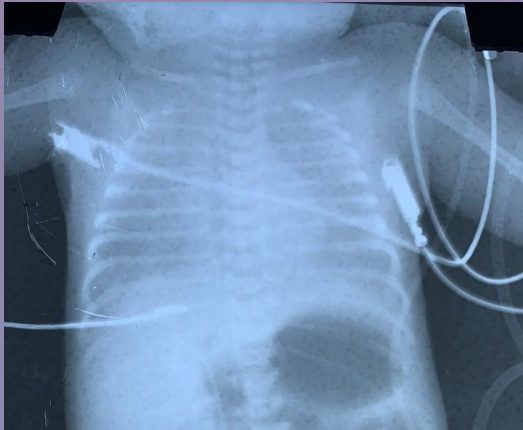
Low chloride formula

Post hypercapnia

- Case 1 – Post hyper-capneic metabolic alkalosis
- Case 2- Iatrogenic thiazide overdose
- Case 3 – Neonatal metabolic alkalosis due to maternal alkalosis
- Case 4 - Pyrolic hypertrophy
- Case 5 – congenital Chloride diarrhea
- Case 6- Pseudo bartter syndrome

CASE -1

- 31 weeks neonate , respiratory distress syndrome on mechanical ventilation. baby required 3 doses of surfactant and medical closure for PDA
- Baby had respiratory acidosis and which improved over 2 days



	Day 1	Day 2	Day 3	Day 4
Ph	7.25	7.32	7.48	7.36
Pco2	67	64	48	44
P02	65	66	76	83
Hco3	18	19.6	23	19
Base excess	-6	-5	+4	-2

- Normal HCO_3^- is extreme preterm – 16-20
- Post hypercapnic metabolic alkalosis
- Respiratory acidosis ---- excretion of excess hydrogen as NH_4Cl and conservation of bicarbonate

- Rapid improvement in lung compliance due to surfactant therapy and mechanical ventilation
- Closure of patent ductus arteriosus
- Fluid restriction in management of patent ductus arteriosus
- Excessive insensible water loss due to prematurity

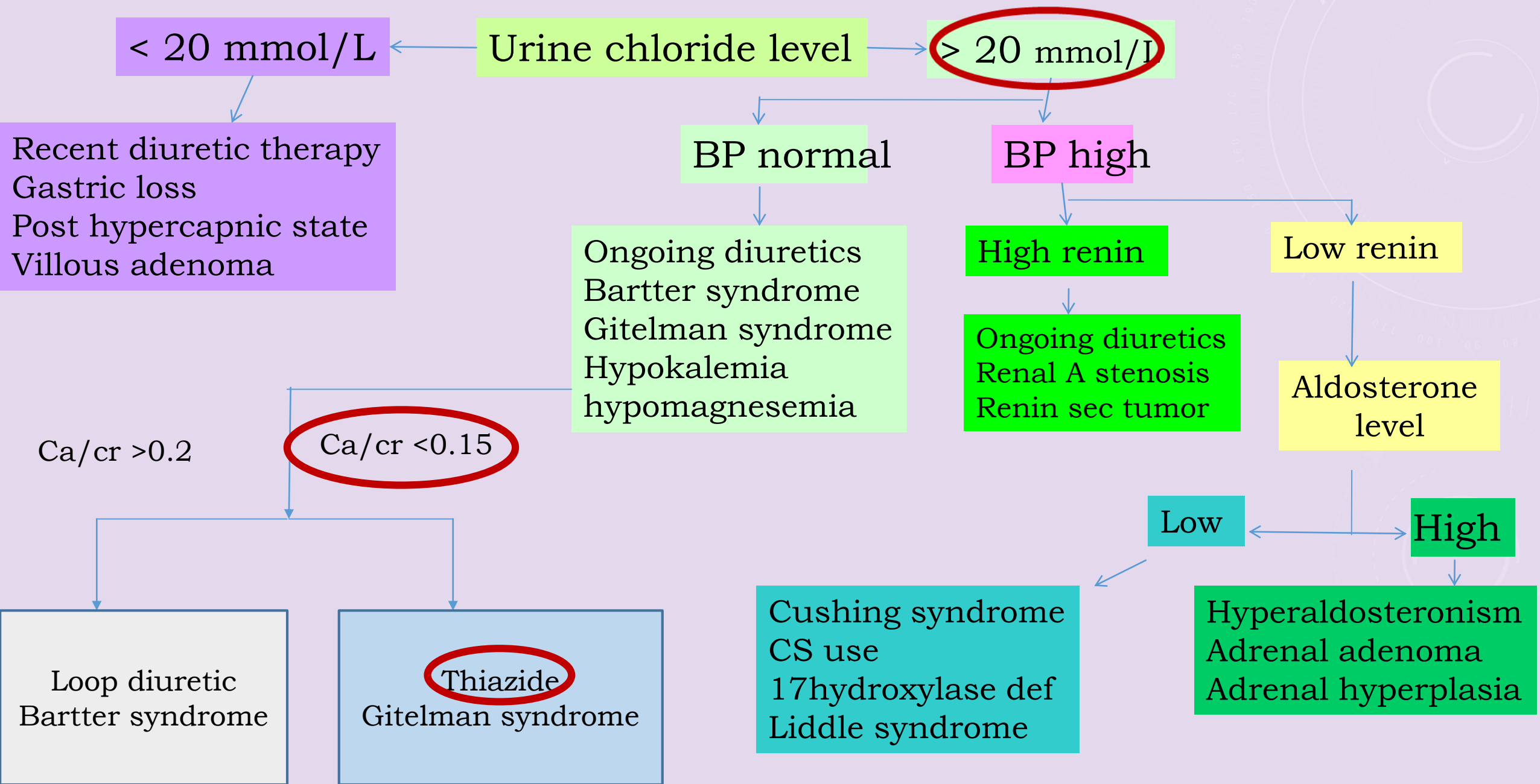
CASE NO 2

- Extreme preterm neonate 26 weeks – required 3 doses of surfactant , mechanical ventilation for 10 days.
- Baby then weaned from mechanical ventilation and started on CPAP.
- On day 18 of life -
- Baby had oxygen requirement more than 40 % with x ray suggestive of evolving BPD baby's pulmonary pressure were also high – secondary pulmonary hypertension.

- Baby is started on low dose dexamethasone and hydrochlorothiazide
- On day 24 of life, baby developed lethargy and hypotonia
- Baby's septic screen was negative and electrolytes showed Na – 90 , chloride -65 k- 2.5 .
- Blood gas – PH -7.5, pco2 – 56 , po2 – 82, hco3- 29, base excess - +9
- Urine Na- 62, k- 49, urine chloride – 56 ,calcium-1.3 and urine ca/creatinine ratio is 0.18

- Hyponatremia
- Hypochloremia
- Hypokalemia
- Elevated urine chloride
- Calcium /creatinine ratio <0.2 (0.18)
- Metabolic alkalosis

Metabolic alkalosis –



- Baby was started on 3% nacl at 1ml/kg/hr for next 48 hours till the sodium reached 120 meq/dl and then started on maintenance dose of 5 meq/kg/day
- Baby was diagnosed to have iatrogenic overdose of thiazide

CASE 3

- 34 weeks neonate delivered by LSCS due pregnancy induced hypertension.
- Baby had a birth weight of 1.2 kg, Normal Apgar score and was on room air with adequate spontaneous respiration.
- Baby developed apnea at 4 hours of life – evaluated for sepsis and started on CPAP.
- Baby's septic screen is negative, Usg cranium - normal

- Blood gas showed – pH-7.65, HCO₃ – 40.2, BASE EXCESS+12
PCO₂ 46 PO₂ -65
- NA -129 meq/l, K-3.1 meq/l, CL- 85 meq/l
- USG KUB – normal
- Baby had an urine output of 3.5ml/kg/hr and no episodes of vomiting
- Baby's urinary electrolytes were – urine chloride 16 meq/l,
urine sodium - 12 urine potassium -8
- Urine calcium/ creatinine ratio is 0.12

- Baby was treated with fluid bolus of normal saline and potassium supplement.
- Baby's condition improved over next 4 days and attained full feeds by 7 days of life.
- Baby was followed for next 3 months , no further episodes of metabolic alkalosis

- Mother had hyperemesis gravidarum requiring hospitalised twice and inadequate weight gain during pregnancy.
- Mother's blood gas – Ph -7.71, Hco₃-44, Pco₂ -36, Po₂-91, Base excess +20. (Two days before delivery)
- Fetal metabolic alkalosis can be due to maternal alkalosis
- Alkalosis causes cerebral vasoconstriction leading to apnea
- Inadequate weight gain is the cause of IUGR and preterm

CASE 4

- 15 days old neonate with failure to thrive and recurrent episodes of vomiting since birth
- Mother has been reassured as GERD which is normal in many neonates due to compliant lower esophageal sphincter
- Baby was admitted on day 15 due to failure to thrive , baby has lost 30% of its birth weight.

- Baby had hypernatremia , Na – 165 meq/l
- K-2.5, chloride – 86,
- ABG- PH- 7.46, pco2 – 44, hco3-28, base excess-+4
- USG abdomen – Pyloric hypertrophy



Pyrolic muscle thickness – 10mm
Pyrolic muscle length -25mm

- Baby was started on saline bolus along with potassium supplementation
- Fluid were given at the rate 1.2 times maintenance of $\frac{1}{2}$ DNS.
- Baby then underwent surgical correction.

CASE 5

- 38 weeks neonate admitted for phototherapy on day 3 of life
- Mother complained for loose stool in the baby
- Mother was reassured as a transitional stool and weight loss was attributed to the physiological weight loss immediate post natal period .
- Baby continued to have 7-10 episodes of loose stools and large volume and watery.

- At day 12 of life, baby has not attained birth weight and lost 23% of the birth weight.
- Neonate was evaluated for sepsis which is negative
- Baby continued to lose weight – supplemented with IV fluids and feeds
- Baby was given a day of nil per oral – frequency of diarrhea remained same –
 - **SECRETORY DIARRHEA**

- Serum electrolytes on day 15 –
- Na- 133 meq/l, k- 2.9 meq/l, chloride -81meq/l
- Stool electrolytes – Na- 42 meq/l, K- 85 meq/l, chloride – 132 meq/l
- **Hypochloremia with increased stool chloride**
- **Stool osmotic gap is 36 –(< 50 suggest secretory diarrhea)**

- Baby had blood gas of PH- 7.54 PCO₂ -42, PO₂-76,HCO₃-31,BASE EXCESS +7

- **Metabolic alkalosis**

- Urine Na – 18 meq/l, k-5 meq/l , urine chloride -12 meq/l

- **Normal urine electrolytes**

- Intestinal mucosal biopsy was done and sent for electron microscopy- reported as normal

- Hypo-chloremic metabolic alkalosis with high stool chloride and low urinary chloride with diarrhea and weight loss
- **congenital chloride diarrhea.**
- Baby was discharged with oral supplements 10meq/kg 3% Nacl and 4 meq/kg KCL

Metabolic alkalosis –

< 20 mmol/L

Urine chloride level

> 20 mmol/L

- Recent diuretic therapy
- Gastric loss
- Post hypercapnic state
- Villous adenoma
- Cystic fibrosis
- Congenital chloride diarrhea**

BP normal

BP high

- Ongoing diuretics
- Barrter syndrome
- Gitelman syndrome
- Hypokalemia
- hypomagnesemia

High renin

Low renin

- Ongoing diuretics
- Renal A stenosis
- Renin sec tumor

Aldosterone level

Low

High

- Cushing syndrome
- CS use
- 17hydroxylase def
- Liddle syndrome

- Hyperaldosteronism
- Adrenal adenoma
- Adrenal hyperplasia

CASE 6

- 37 weeks neonate with birth weight of 2.9 kg delivered by LSCS
- Antenatal history of fetal ascites in early third trimester, which resolved spontaneously
- Neonate had abdominal distension from day 1 –kept NPO



- Post –operatively baby had
 - weight loss
 - Increased stool output
- Serum electrolytes
 - Na- 129 , k- 2.3, chloride – 87
- Blood gas – PH- 7.43, PCO₂ – 31, po₂- 75, HCO₃-24 , base excess --+3
 - Metabolic Alkalosis

	POD 3	POD 4	POD 7	POD 8
PH	7.43	7.42	7.36	7.26
PCO2	31	33	36	33
PO2	77	67	75	68
HCO3	24	22	18	15
BASE EXCESS	+3	+2	-4	-8

- Metabolic alkalosis which was attributed to volume contraction progressed to metabolic acidosis due to loss of HCO₃ from the intestinal fluid and high stool water output causing dehydration and hypo-perfusion

- At 28 days of life , neonate had severe failure thrive
 - Weight loss from 2.9 kg – 1.9 kg
- Neonate was started on elemental formula diet and amino acid based diet
- Baby continue to lose weight
- Reanastomosis was delayed as –
 - There is significant difference between the ileostomy loops



AT 45 DAYS

- Baby continued to lose weight (weight -1.6kg)
- Baby then under went Re-anastamosis- on day 45

ON DAY 51 ,

- Baby had metabolic alkalosis ,

	Day 51	Day 52	Day 53
Ph	7.576	7.523	7.54
Pco2	46.3	39.6	42.4
Po2	87.9	109	97
Hco3	42	31.8	33.2
Base excess	+20.1	17.7	15.4

- Serum electrolytes

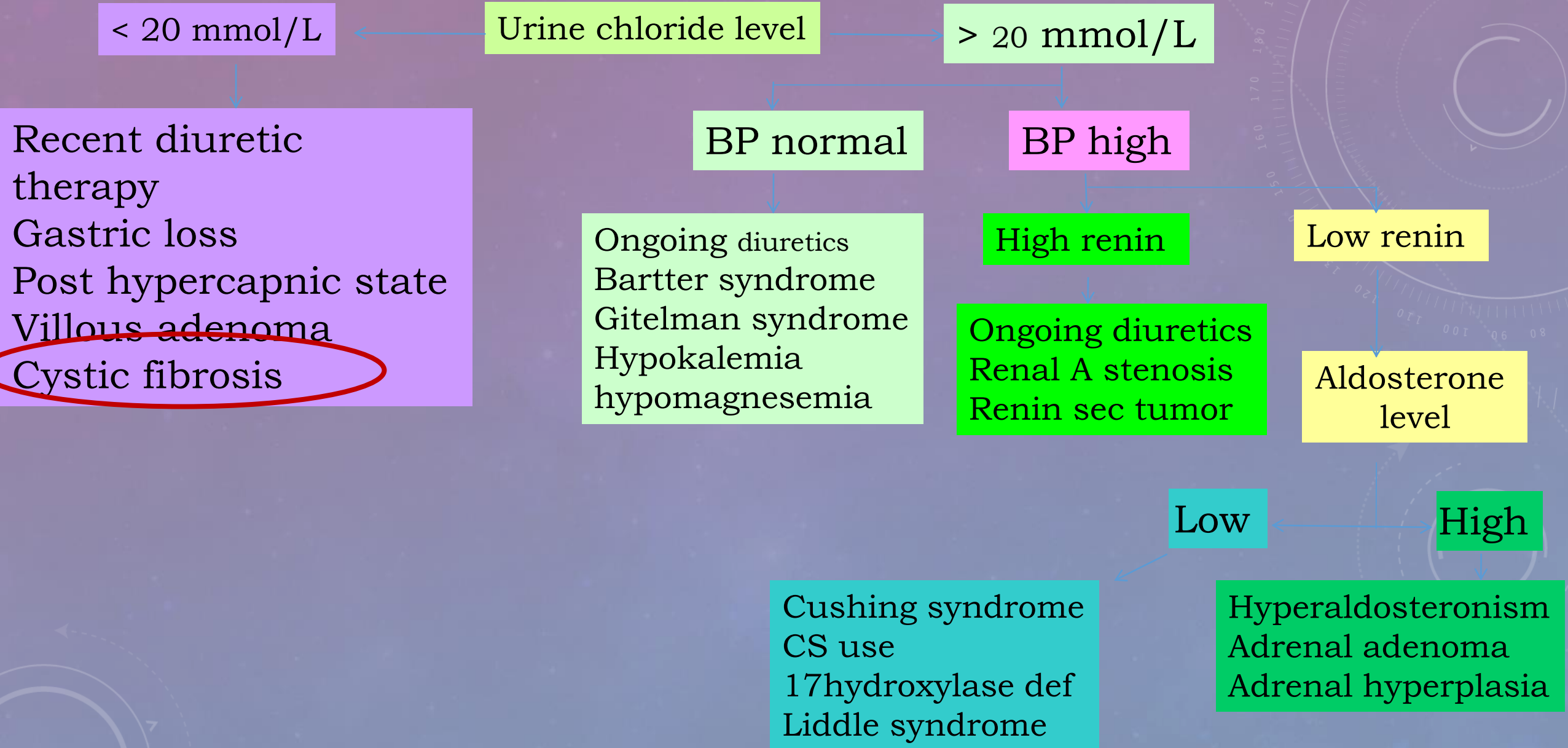
	Day51	Day 52	Day53	Day 54
Na	133	135	128	129
K	2.9	3.1	2.7	3.3
CL-	81	88	86	84

- Urine electrolytes

URINE SPOT	DAY 53	DAY 54
Na	17	15
K	39	49
CL-	10	12
CA/CR	0.12	0.17

- Hypo-chloremic, Hypo-natremia, hypokalemia
- Metabolic alkalosis
- Normal urine chloride and elevated urine potassium
- Cystic fibrosis screen positive – immune reactive trypsin
- Meconium ileus
- Nephrocalcinosis – USG KUB

Metabolic alkalosis – Suggestive history/ABG/electrolytes



- Pseudo bartter syndrome

At 59 days

Baby developed anastomosis failure, Pneumoperitonium and necrotizing Enterocolitis and klebsiella sepsis with severe systemic inflammatory response syndrome



NEONATAL CAUSES OF METABOLIC ALKALOSIS

Acid loss	Vomiting, pyloric stenosis ,nasogastric suctioning
Diuretics	Loop, thiazides
Chloride deficiency	Chloride losing diarrhea, barter syndrome, cystic fibrosis, congenital adrenal hyperplasia (with hypertension),maternal hypochloremia
Administration of alkali	Bicarbonate ,acetate, citrate, lactate