# Antihypertensives

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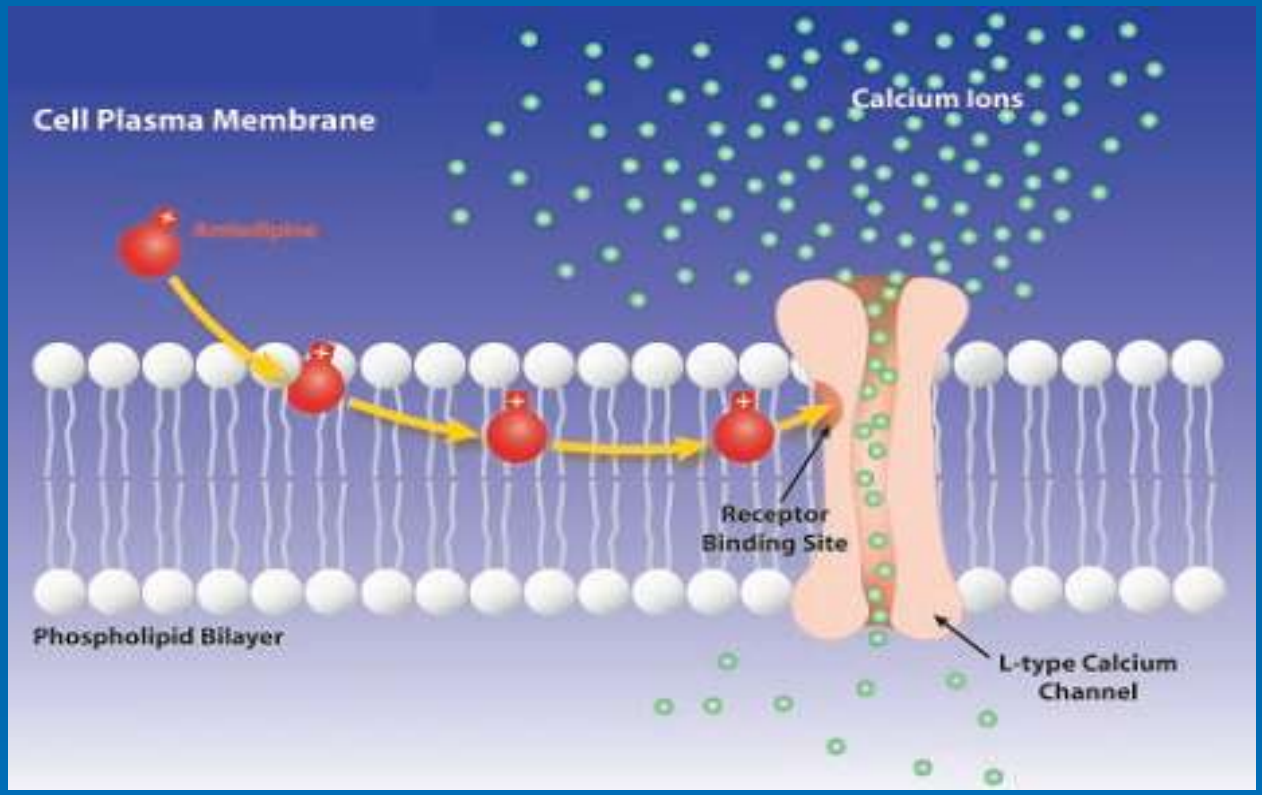
# General Principles

- Once daily dosing preferable when possible to aid adherence.
- Children (<1 yr) may need multiple daily dosing to increase dose flexibility e.g. propranolol rather than atenolol; captopril rather than enalapril.
- Commence at starting dose in BNFc and gradually titrate until target BP achieved.
- In infants or those with impaired cardiac function it may be necessary to initiate antihypertensive medication in hospital with BP monitoring – these patients should be discussed with a paediatric nephrologist.

# Calcium Channel Blockers

# Calcium Channel Blockers (CCBs)




http://media.pharmacologycorner.com/wp-content/uploads/2009/11/CCB_mechanism_of_action.jpg

- Stop $Ca^{2+}$ entering vascular smooth muscle:
  - Peripheral vasodilation and decreased vascular resistance.

# CCBs- Issues

- Common Side Effects
  - Peripheral Oedema (8%)
  - Fatigue (4%)
  - Flushing (2%).
- Interactions:
  - Metabolised by CYP3A4, but few ***significant*** interactions.
  - Interaction with grapefruit juice (caution with amlodipine, avoid with nifedipine).

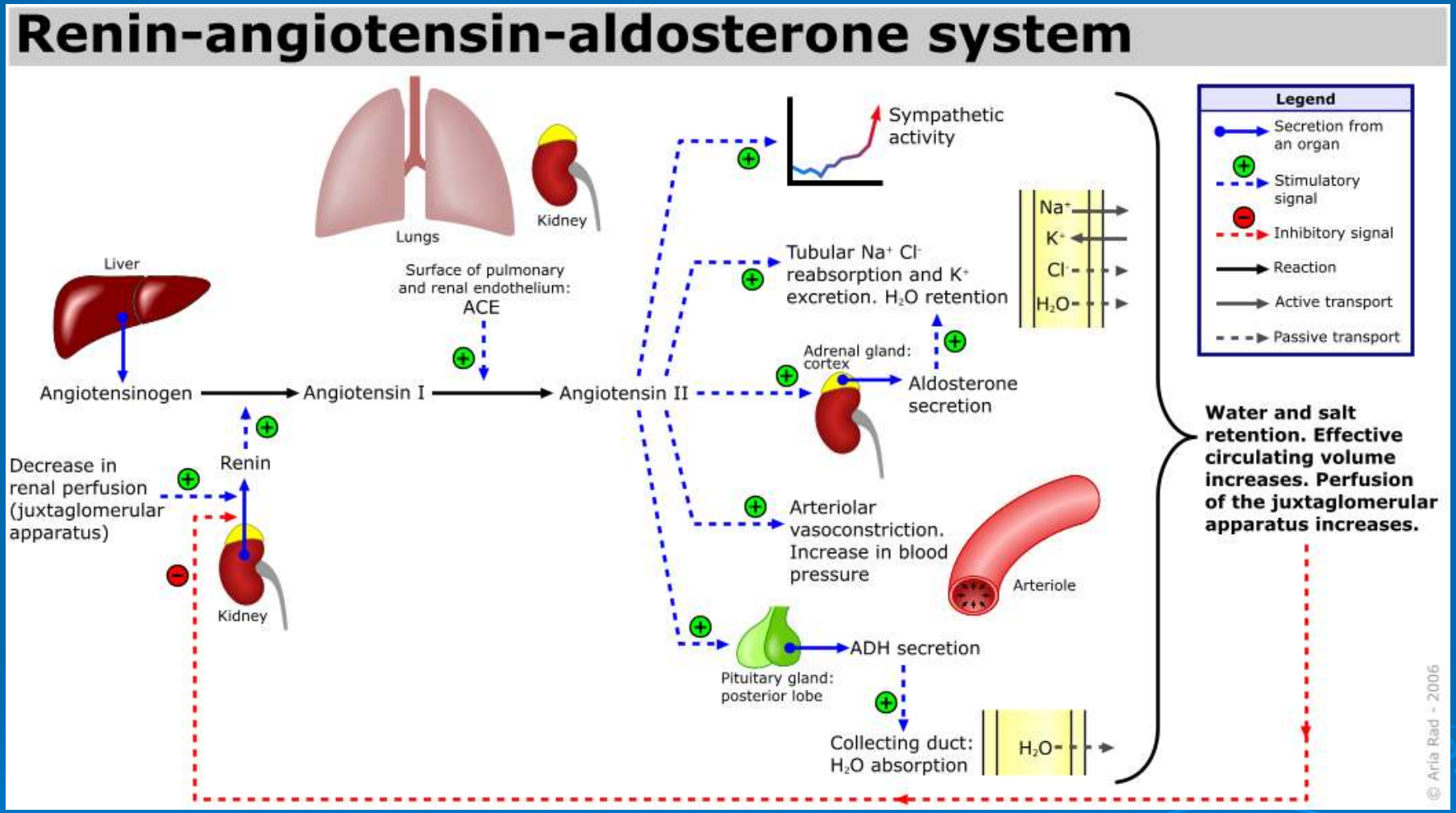
# Nifedipine

- Onset of Action:
  - “Sublingual”: 1-5 mins.
  - Immediate-release tablets: 20-30 mins.
  - MR Tablets: 2.5- 5 hours.
- Duration of action:
  - Immediate release 4-8 hours.
  - MR: depends on brand.
- Immediate-release
  - Not recommended long-term.
    - BP fluctuations
    - Reflex tachycardia
  - Drops  or capsules.
  - Doses > 250 microgram/kg not normally appropriate.
- SR tablets
  - Suitable long-term
  - Multiple brands.
  - 12 vs. 24 (MR vs.. LA)
  - Cannot crush.

# Amlodipine

- Half-life 30-50 hours.
  - Duration of action >24 hours.
- ? Increased clearance in children < 6 years
  - ? Split daily dose and give 12-hourly.
- Liquid preparation not commercially available.
  - Specials expensive with short shelf-lives.
  - Tablets disperse well in water.

# ACE Inhibitors




http://upload.wikimedia.org/wikipedia/commons/a/a2/Renin-angiotensin-aldosterone_system.png

# ACE Inhibitors- Side Effects

- Renal Impairment (0.1-1%)
- Hyperkalaemia (11%)
- Cough (0.5-2%)
- Angioedema (0.1%)
- Rash (4-7%)

(Incidence data based on captopril- some inter-agent variability)

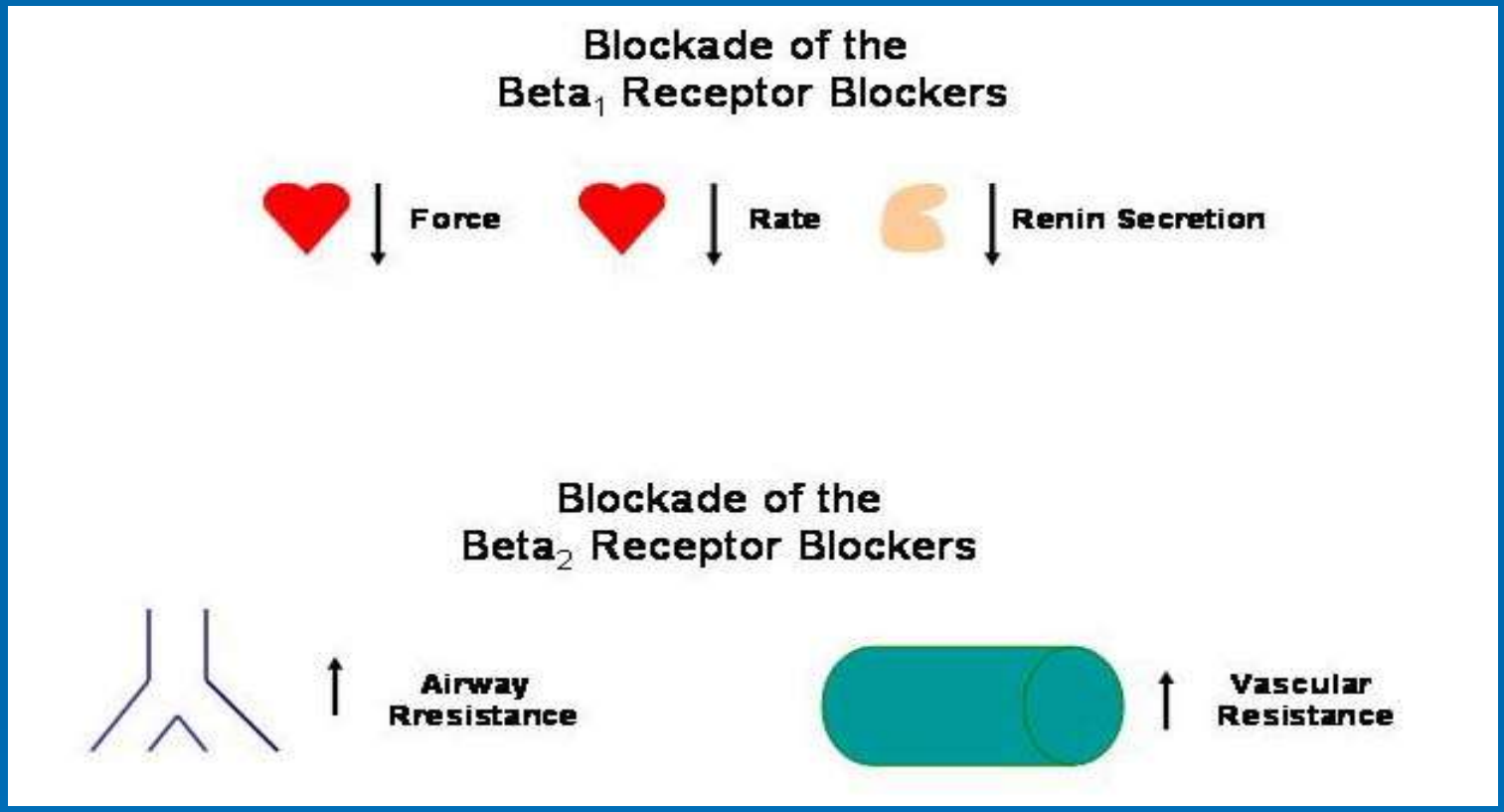
# ACE Inhibitors- Initiation

- Check U&Es 7-10 days after starting/increasing dose
  - Review if eGFR change is ≥25% or plasma creatinine ≥30% (NICE)
- Counsel teenage girls about contraindication in pregnancy
- Counsel regarding importance of stopping whilst unwell with diarrhoeal or vomiting illnesses.
- Losartan may be tried as an alternative is ACEi not tolerated.
  - Limited data in children <4 years.
  - “Double-blockade” sometimes used.

| Drug | Dosing Frequency | Evidence for use in Children | Preparations |
|---|---|---|---|
| Captopril | TDS | Good evidence to support use in neonates-18 years. | Tablets, 1mg/mL and 5mg/mL liquids. |
| Enalapril | OD/BD | Evidence to support use in neonates-18 years. | Tablets can be crushed and made into a suspension. Removes the need for expensive Specials. |
| Lisinopril | OD | Limited evidence in children < 6 years | |

# Beta Blockers

http://www.uky.edu/~mtp/Beta%20Blocker%20resize.jpg



# Beta Blockers- Choice

Propranolol:

- Non-selective.
- Liquid or tablets.
- TDS dosing if < 12 years, otherwise BD.
- OD SR capsules also available.
- Avoid in asthma/history of bronchospasm.

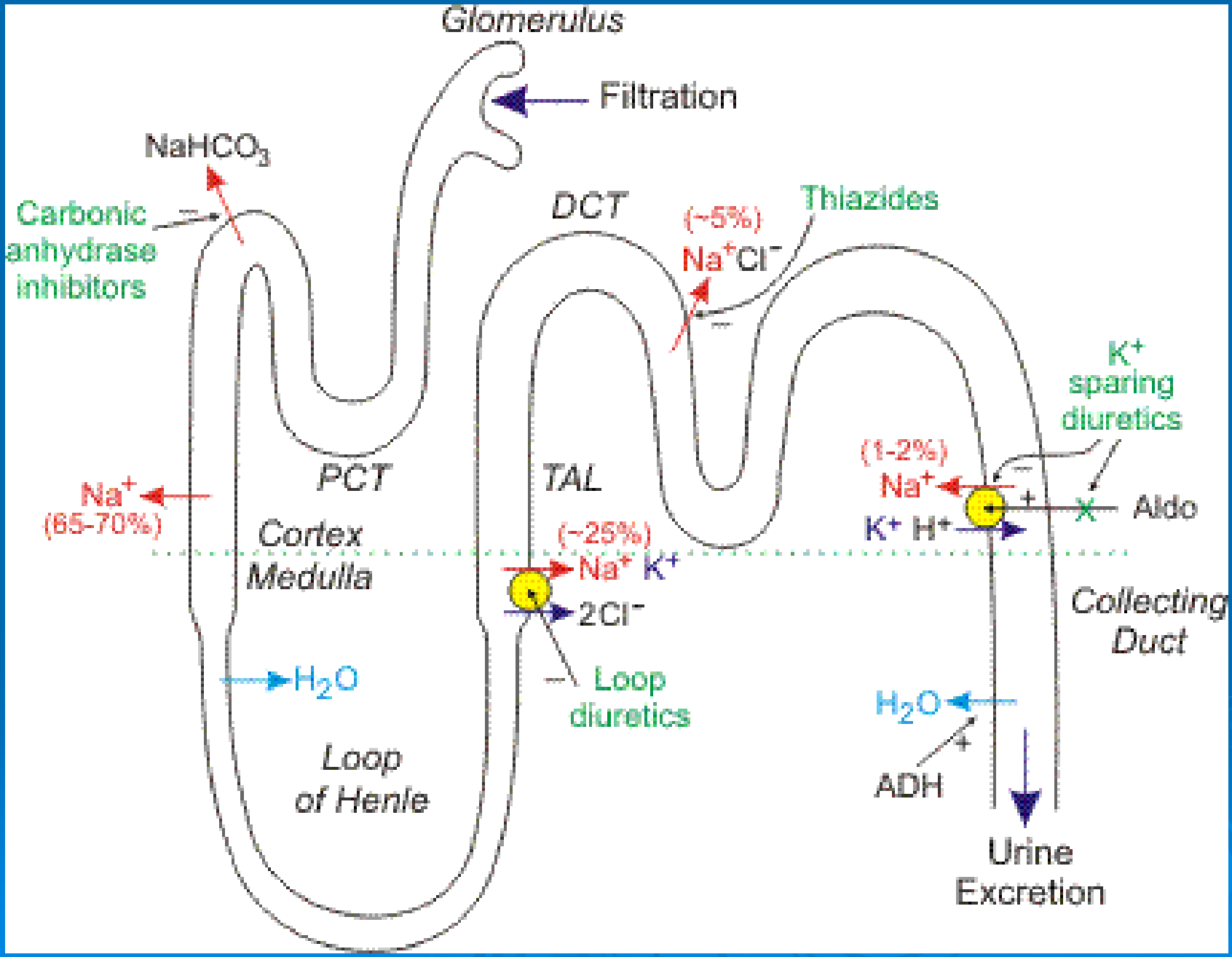
Atenolol:

- $Beta_1$-selective
  - Should still avoid in asthma if possible.
- Liquid or tablets.
- Usually OD dosing but can split to BD:
  - Reduced half-life in children < 10 years.

# Beta Blockers- Side Effects

- Fatigue (5-26%)
- Dizziness (4-12%)
- Cold extremities (12%)
  - Possibly worse with atenolol?!
- Dermatitis, pruritus, urticaria.
- Sleep disturbances and nightmares
  - Propranolol > Atenolol
- Bronchospasm

# Diuretics


Glomerulus
Filtration
$NaHCO_3$
Carbonic anhydrase inhibitors
DCT
(~5%)
$Na^+Cl^-$
Thiazides
$K^+$ sparing diuretics
(1-2%)
$Na^+$
Aldo
$K^+$ $H^+$
PCT
TAL
$Na^+$ (65-70%)
Cortex
Medulla
(~25%)
$Na^+$ $K^+$
$2Cl^-$
Collecting Duct
$H_2O$
Loop diuretics
Loop of Henle
$H_2O$
ADH
Urine Excretion

# Furosemide- Side Effects

- Hyperuricemia
- Hypomagnesaemia
- Hypokalaemia
  - Rare, but more common in young children.
- Loss of appetite
- Bladder spasm
- Orthostatic hypotension
- Photosensitivity reactions

# Diuretics- Advice to Patients

- Counsel regarding importance of stopping medication whilst unwell with diarrhoeal or vomiting illnesses .
- Risk of photosensitivity reactions with furosemide:
  - High SPF sun creams.
- Diuresis tends to diminish over time, but avoid dosing in the late afternoon if possible.
  - Duration of furosemide action 6-8 hours.

# Any questions?


THE
END